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ABSTRACT

This theme issue contains 20 articles dealing with technology in the classroom. The articles are: (1) "Distance Learning and the Future of Kamehameha Schools Bishop Estate" (Henry E. Meyer); (2) "Technology and Multiple Intelligences" (Bette Savini); (3) "Technology Brings Voyagers into Classrooms" (Kristina Inn and others); (4) "Technologies Old and New: Teaching Ancient Navigation" (Simon Spalding); (5) "That's a 'Wrap'" (Patricia Gillespie); (6) "Computer Learning for Young Children" (Anita Y. W. Choy); (7) "Free in First Grade: Technology in One Classroom" (Cathy Weaver); (8) "New Technologies, New Curricula" (Gisela E. Speidel); (9) "The Electronic Student Portfolio" (Emily Fasick and Clemence McLaren); (10) "Video Literacy at Waiau Elementary School" (Ralph Ohta and Joseph Tobin); (11) "A Hitchhiker's Guide to Technology" (Ian Jamieson); (12) "Adventures with 'The Geometer's Sketchpad'" (Cathi Sanders); (13) "Taking a Giant Step into Our Technological Future" (Gisela E. Spiedel); (14) "MIDAS Has the Golden Touch!" (Irene Yamashita); (15) "Who's in the Driver's Seat?" (Robert G. Peters); (16) "A Few Bytes of Technological Advice" (Curtis Ho); (17) "Information Literacy: A Challenge for Critical Thinking" (Elaine Blitman); (18) "How Does Technology Affect Society?" (Gail Tamaribuchi and Ramona Newton Hao); (19) "Computers and Clarifying Mathematical Thinking" (Robin Durnin); and (20) "Charting the Future" (Lance Tachino). (TJQ)

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THE KAMEHAMEHA

# Journal of Education

VOLUME 6, SUMMER 1995

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# Technology In The Classroom

PS 023694

KAMEHAMEHA SCHOOLS BERNICE PAUAHI BISHOP ESTATE

EDITOR
Gisela E. Speidel, Ph.D.

ASSOCIATE EDITORS
Ramona Newton Hao
Kristina Inn

PRODUCTION EDITOR
Kristina Inn

SUPPORT STAFF
Virginia Mau

COVER:
Photos by Ramona Newton Hao
Collage by Solid Concepts, Inc.

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*The Kamehameha Journal of Education* publishes articles on the education of Hawai'i's children. This journal is for teachers, principals, curriculum developers, college and university faculty, superintendents, and those in political arenas; in short, it is for anyone concerned with educational matters. Journal issues center around themes—educational programs, teaching strategies, instructional settings, cultural and learning-style differences, and current educational concerns—all dealing with ways Hawai'i's children come to enjoy school and to succeed in it.

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KAMEHAMEHA SCHOOLS BISHOP ESTATE

# MEMORANDUM

September 1, 1995

To : *The Kamehameha Journal of Education* subscribers
From : Michael J. Chun, Ph.D., Kamehameha Schools President

Aloha. This issue of *The Kamehameha Journal of Education, Volume 6, Summer 1995*, on "Technology in the Classroom" is the last that Kamehameha Schools Bishop Estate will publish.

Kamehameha's Early Education Division, which coordinated editorial and production for the journal, closed in June as part of a restructuring of KSBE's educational services.

My sincerest mahalo to the journal staff for creating this wonderful educational forum and maintaining its high level of quality and professionalism. It allowed Hawai‘i educators to share their views and experiences on topics ranging from standardized testing to approaches to teaching writing to elementary school students.

Free copies of the current issue of *The Kamehameha Journal of Education* and limited quantities of past issues are still available from KSBE's Media and Publications Department, 1887 Makuakāne Street, Honolulu, Hawai‘i 96817-1887.

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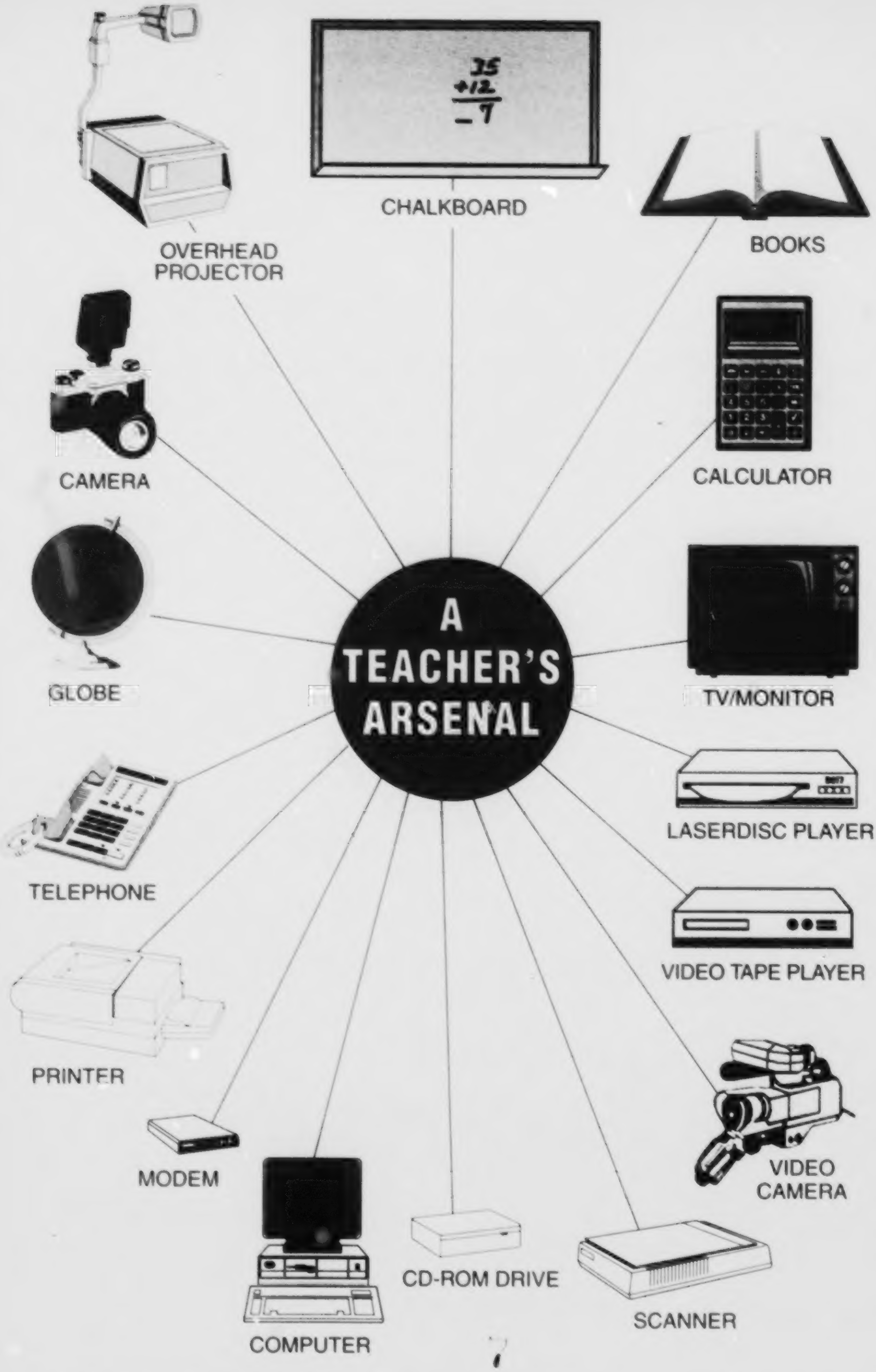

A TEACHER'S ARSENAL
OVERHEAD PROJECTOR
CHALKBOARD
35
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_7
BOOKS
CAMERA
CALCULATOR
GLOBE
TV/MONITOR
TELEPHONE
LASERDISC PLAYER
VIDEO TAPE PLAYER
PRINTER
VIDEO CAMERA
MODEM
COMPUTER
CD-ROM DRIVE
SCANNER

# Distance Learning and the Future of Kamehameha Schools Bishop Estate

## Henry E. Meyer

---

***Henry E. Meyer** was for 15 years a high school teacher and a football and track and field coach. For the past decade, he served as administrator at Kīhei Elementary, Lokelani Intermediate, and Maui High Schools and then moved to the Maui District Office of the Department of Education, where his responsibilities included the supervision of computer education, distance learning, telecommunication services, AV-media, and libraries for the 29 district schools.*

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Founded by Ke Ali‘i Pauahi more than a century ago, Kamehameha Schools has been the educational cornerstone in the lives of thousands of Hawaiian students. Through the decades, this great institution has gone through numerous shifts and adaptations that have improved and expanded educational opportunities for the beneficiaries of Pauahi's legacy. Now, as the twenty-first century rapidly approaches, the winds of change blow once again to challenge the traditional levels of comfort from which we extend education to new generations of learners.

All learners from this day forward must become proficient at gathering, evaluating, and synthesizing enormous amounts of information from electronic, digital sources along with those available through older, paper-based technologies. They will have to create, store, and transmit messages, stories, business documents, or works of art using computers, camcorders, or CDs as easily as they use pencils, crayons, or paper.

The Kamehameha Schools Bishop Estate (KSBE) will have to meet this challenge for change head-on and provide our learners with the tools, insights, and skills necessary for their success in the coming electronic, digital age. Some of the ways we are dealing with this challenge are outlined in other articles in this issue; others I will discuss here.

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## Distance Learning

One way we plan to meet this challenge is through distance learning. Distance learning is really nothing new. It simply means that a source of information, *kumu* or teacher, is separated from the learner, *haumana* or student, by distance or time. Distance learning takes many forms, from older correspondence courses to state-of-the-art courses with full motion, two-way video where instructor and students see and talk to each other in real time. What is *new* about distance learning programs are the fast, efficient, and cost-effective digital and electronic tools used to send information to learners and to allow them to interact with their *kumu*.

Video-based distance learning is already taking place in Hawai'i. For five years now, the Department of Education has been offering for high school credit Advanced Placement Calculus and, during the summer, Analytic Geometry via statewide cable television to schools like Kohala, Lāna'i, Waimea, Lahainaluna, and Ka'ū. Assessments and evaluations have proven the effectiveness of these courses. By the time this article goes to press, about 500 students will have successfully completed and received credit for these two televised courses; most of the AP Calculus students will receive college credit, too. The mind-boggling fact is that each and every one of these students would never have had the opportunity to study these advanced subjects in high school were it not for telecommunications.

Distance learning will inevitably play a role in KSBE efforts to reach more Hawaiian students efficiently and effectively. In September, 1994, we entered the TV distance learning arena with a weekly Hawaiian language show, called *Kulāiwi*, taught by J. Ekela Kaniaupio-Crozier, with technical and talent support from Marsha Bolson, Richard Rapoza, Larry Loganbill, and several KSBE students. The highly successful show is designed to encourage use of the Hawaiian language among Hawaiians, and even non-Hawaiians, of all ages.

Another distance learning success story is the Department of Education's *KidScience* program that provides enriching science lessons for fifth and sixth graders. For four years now, *KidScience* teacher Patty Miller has been making science more fun and rewarding for over 15,000 children and their teachers. In April and May of this year, three of our Kamehameha Elementary students and Hawaiian Studies guru Gordon Pi'ianai'a participated in several nationally televised *KidScience* specials. Included in these specials were live conversations with crew members of the sailing canoes on their historic return voyage to Hawai'i from the Society Islands.

The widely respected human and artifact resources of KSBE may some day provide a program modeled after *KidScience* to enhance courses in Hawaiian history and culture, not only for Hawaiian students, but for anyone interested in these topics. In the years to come, we hope that more and more of our Kamehameha Schools teachers will participate in these instructional distance programs to share their knowledge of Hawaiian language and culture and of other subject areas. With the opening of satellite schools on neighbor islands, distance learning will play an even more significant role in KSBE's future.

Teachers and other educational staff will also be able to receive training via screen technology. A vast array of distance-learning credit courses for teachers are already available via the Hawai'i Instructional Television Service of the University of Hawai'i and various other educational satellite-cable networks, the most famous being Mind Extension University. Courses can be taken "live," having voice or e-mail interaction with the instructor, or "time-shifted," using the VCR to record and watch at a more convenient time and corresponding with the instructor via e-mail. Plans are already underway for the University of Hawai'i Office of Community Colleges to offer cable-television credit courses in areas such as safety, building and grounds maintenance, food preparation, health care, and accounting. This will make it possible for our KSBE staff who work in these areas to take part in such training opportunities.

### Internet

The task of networking KSBE students, teachers, and staff members with each other and the rest of the world is already taking place. Full Internet service via a digital-frame relay link to the Maui High Performance Computing Center at Kihei is available in the Kamehameha Secondary School library. This full service will be extended over the next two years to classrooms, labs, and dormitory study halls.

KSBE will be putting up a Home Page on the World Wide Web to enable people from around the world to learn about our school and organization through multimedia programs produced by students and staff.

Through Internet, KSBE teachers and staff will be able to communicate among themselves and the neighbor island offices via e-mail; they will be able to dial up to the campus and the libraries to do research or other tasks from home. Also, using our access to Internet, alumni of Kamehameha Schools will be able to communicate with each other.

## Hawai'i Educational Wide Area Network

The Kamehameha Schools Bishop Estate has a long history of partnering with the public schools in an attempt to reach Hawaiian students throughout the islands. Because of this symbiotic relationship, Kamehameha Schools has been invited to be part of the Wide Area Network that will include every public school. Our teachers will be able to exchange information with their public school colleagues anywhere in the state and participate in electronic bulletin boards and mail. It will also allow our campus staff to be in touch with teachers and staff that work in preschools and other KSBE programs located at public schools throughout the state.

Our classrooms will be able to interact electronically with any public school class, and I can see the day when electronic learning circles will be commonplace. An excellent example of a learning circle is the sixth-grade class of Mrs. Stephanie Kamake'eaina at Lokelani Intermediate School on Maui. Her students are part of an AT&T-coordinated learning circle among students all over the United States, Canada, Japan, and parts of Europe. The students exchange materials and compare environmental problems and solutions unique to their country.

## Campus Closed-Circuit and Cable TV

By the time you read this article, a fiber-optic cable backbone will already be installed among all major buildings on the campus to allow the passage of high quality video, data, and voice communications to and from the outside world and from the Schools' library of videos and software programs. Programs that will reach classroom televisions will come from providers like Oceanic Cable and from satellite dish receivers. These programs will include private conferences purchased from vendors such as the Educational Management Group; University of Hawai'i classes off of a HITS/ITFS receiver; productions by students at our video studio; classes produced at the distance-learning studio to be built on campus; computer-generated textual bulletins with campus announcements; school news; *et cetera, et cetera.*

To give a flavor of the future and the choices that staff and students may have at any given hour, here is an imaginary program schedule that could be showing at 9:00 A.M. on Tuesday, January 7, 1999.

| Channel | Program | Source | Other Information |
|---|---|---|---|
| Channel 1 | CNN Headline News | Oceanic | |
| Channel 2 | Advanced Placement Calculus | HITS/Oceanic/'Olelo | Presently originating each day from Maui High School |
| Channel 3 | Video field trip to the Uffizi Gallery in Florence, Italy (LIVE) | Turner Television | Such programs will be available this spring to participating schools |
| Channel 4 | Videoconference view of KSBE Trustees in a question & answer session with a 12th-grade science class (LIVE) | KSBE campus | |
| Channel 5 | Videoconference view of a Washington D.C. middle school class discussing school dress codes with KSBE 7th graders | Coordinated by EMG | One of their services off Satellite G-7 |
| Channel 6 | Computer Bulletin Board with announcements for students & teachers | KSBE campus | A one-way computer originated (scan converted) bulletin board |
| Channel 7 | The Discovery Channel | Oceanic Cablevision | |
| Channel 8 | Psychology 623, a University of Hawai'i graduate course | HITS | Allows teachers to record & view later to earn credit & upgrade their classroom skills |
| Channel 9 | Demonstration by KSBE science resource specialist on how to conduct experiments using various types of limu for all 4th-grade students & teachers at the same time | KSBE campus | This is to be followed by viewers engaging in experiments themselves once demo is pau |
| Channel 10 | KSBE Morning News produced by students in the high school television production class (TAPED) | KSBE campus | Rebroadcast from LIVE presentation done at 7:45 A.M. for staff members, campus visitors & those unable to view the earlier show |
| Channel 11 | C-SPAN | Continuous feed processed off Satellite F-3 | |
| Channel 12 | The KSBE Channel | KSBE campus | Enables persons on campus to monitor programming being fed LIVE statewide to Oceanic and then to all cable-TV systems statewide; the program on presently is intended for use at all KSBE preschool sites everywhere and focuses on learning how to use numbers and count in the Hawaiian language |
| Channel 13 | Court TV - The Simpson Trial, now into its fourth year! | Continuous feed processed off Satellite F-3 | |
| Channel 14 | The Government Access Channel - Honolulu City Council in session (LIVE) | Oceanic/'Olelo | Viewers can let council members know their opinions through a keypad response system that Oceanic has established |
| Channel 15 | Videoconference view of high school students in Tahiti interacting with a 9th-grade beginning French class on KSBE campus (LIVE) | KSBE campus | In return, a class of our 9th-grade English students occasionally interacts via videoconferencing with peers in Tahiti to help them learn to speak English |
| Channel 16 | 3-way videoconference—The Governor of the State of Hawai'i (from his office) is meeting and answering questions from 11th-grade students at Maui High School and KSBE in American government classes simultaneously (LIVE) | | The Governor, because of his understandably tight schedule, cannot take the time to travel to the campuses but is very willing to meet and answer questions through the video medium |

Schedule for 9:00 A.M. Tuesday, January 7, 1999

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## Conclusion

I have described only a sample of the kinds of exciting learning opportunities students and teachers of KSBE will have available to them. Although the new electronic, digital, and optical technologies are not a panacea, they are already altering the ways our children view and respond to the world around them. These are the media of coming generations, whether *we* like them or not! We have a huge responsibility to fulfill: we must help our youth, our *'ōpio,* know, appreciate, and preserve the artful beauty and cultural strengths derived from our Hawaiian past, while at the same time we must assist them to become adept in a constantly fluid world of screens, keypads, joysticks, and terabytes.

These new technologies give the word *sharing* further meaning. Our students, teachers, and staff will be able to learn and broaden their experiences by accessing a world-wide network of knowledge; the world, in turn, will gain from the programs KSBE will share on this network.

# Technology and Multiple Intelligences

## Bette Savini

---

**Bette Savini,** *fourth-grade teacher at Kamehameha Elementary School, has taught elementary school for 25 years. Bette has found support for her teaching philosophy in Howard Gardner's theory on multiple intelligences and worked during a sabbatical year at Fuller School where Howard Gardner's work was piloted. True to her love for different intelligences, she enjoys her role as "Team Mom" for Little League and AYSO Soccer, and she serves on the SCBM Board for Sunset Beach School.*

---

Entrenched in our society is the notion that intelligence is a general mental ability: the fortunate have more of it, the less fortunate have less. Perhaps this common belief stems from our typical classroom I.Q. test, which claims to test intelligence with verbal or mathematical problems by filling in little circles or ovals and using paper and pencil as tools. Some children do well on it and others do poorly. Those who do well are usually the better students in our extremely verbal and logical-mathematical schooling system. Therefore, we think, these must be the intelligent ones.

In my 25 years of teaching, I have found that the truly committed teachers look far beyond this narrow view of intelligence. They recognize the great diversity in abilities among their students: some are avid readers, some are athletic, some are little psychologists, some are storytellers, some love to do puzzles and build with blocks, some love to paint or make music.

Teachers must be particularly sensitive to these different abilities in their students because they must find a strength, any strength, upon which to build the child's belief of himself as a learner. For we are the artists painting upon a canvas a most important masterpiece—the child's view of himself as a learner. Somewhere long ago, I read a note from a student to his teacher, "How you see me, I will see me; and how I see me will *be* me."

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Therefore, we need to search for the wonderful things in each child. If we find the strengths in a child, the child will sense this strength, will come to believe in it, and will become confident that he can learn; he will take risks, he will get involved and thereby will develop his other abilities, his other intelligences. Making this happen is a classroom teacher's victory to share with the student. It is the heartfelt, silent "Amen and thank you, God" whispered often; it is what makes those many nights spent wondering about a certain child and how to break through to his spirit so worth the time, worth the effort and energy.

In searching for the wonderful things in a child, we teachers have held a philosophy similar to Howard Gardner's[1] theory of multiple intelligences. Instinctively, we knew children were not all the same, that they had strengths in different areas. Unfortunately, standardized testing, grading, and intelligence tests haven't recognized that.

Howard Gardner has brought to light and made respectable the theory that there are at least seven kinds of intelligence: linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal. He has supported his theory with research from diverse fields—developmental psychology, anthropology, cognitive psychology, psychometrics, neuropsychology, and biographical studies.

Each of us possesses the seven intelligences, some of them to a greater degree and some to a lesser. We can all think of friends and family members, famous historical figures, and individuals in different professions and cultures who are outstanding in one or more of these intelligences. Our society honors and often pays large amounts of money to those who are exemplary, not only in writing and mathematics, but in sports (Michael Jordan and Joe Montana), in music (the Beatles and Yanni), in dance (Mikhail Baryshnikov), in exploring and wayfinding (Nainoa Thompson).

While the theory of multiple intelligences celebrates differences, the idea from a teaching standpoint is to develop all the potentials of a child. Guided by this theory, Fuller School has as its mission statement: "We challenge and we kindle. We're about abilities, competence, options, craft, handiness, proficiency, ingenuity, and resourcefulness."

So where does technology fit into multiple intelligences? I'm a humanist and in teaching I have focused on the development of speaking and communication skills, the human side. Many of the children we teach need to learn to be more communicative. Furthermore, I believe learning is not instantaneous; learning takes time. Therefore, I have been skeptical about technology, worrying that it takes time away from speaking, from the conversations, and questioning the value of a medium that feeds into the already short attention span of our students.

Then several years ago, I began to work with other sixth-grade teachers at Kamehameha on piloting *The Voyage of the* **Mimi**,[2] a science and math program that relies heavily on technology. Although new at the school and somewhat uneasy at becoming a part of a team that had been working with the program for a year or so, I soon began to love the program.

Why? The students in my class were very diverse: some were strong readers, others were weak readers; some loved to listen, others preferred to do things with their hands; some were musical, some were artistic; many loved to talk with each other and discuss things. What I noticed was that the Mimi program had so many ways of conveying information and getting children to participate that every child was able to learn the information. Many of my students wouldn't have picked up the textbook that accompanies the program if it hadn't been for the discussions, the videos, the writing, the computer games, and the other non-reading kinds of activities. It was these activities that lured the students into reading the text, eager to find out more.

It wasn't until I began to read the literature on Gardner's multiple intelligences theory (particularly, Thomas Armstrong's[3] interpretation of that theory for teachers and parents) that I began to get a deeper understanding of why the Mimi program with its many technology components had been so satisfying to teach and why all the students had been so interested, so involved, and had learned so well.

*The Voyage of the* **Mimi**, developed by Bank Street College in the eighties, is a multimedia program used by hundreds of teachers in the United States. The program is based on the story of a group of scientists and research assistants who charter the vessel *Mimi* to study humpback whales. The story is presented on videotape in 13 different episodes about the adventures of the research group. Each Episode is accompanied by a videotape of an Expedition or documentary that elaborates on an event or concept in the Episode. There is a student-text version of the Episode and Expedition videos, which allows students to read over the events and information at their own pace. A teacher's guide gives suggestions about theme-based instruction, language-arts extensions, and explorations of interdisciplinary connections.

There are, moreover, four computer modules for further learning and problem solving. In Maps and Navigation the students search for a buried treasure, skirt a hurricane at sea, pinpoint *Mimi's* location, and rescue a whale. In Explore and Discover students can access a videodisc to explore and research interdisciplinary topics. There is a feature which combines computer-based writing activities and student-edited video clips. Ecosystems has students survive on a deserted island for a year without disrupting the ecosystem. And Whales and Their Environment consists of a combination of software and hardware that permits students to conduct experiments with light, temperature, and sound.

Figure 1 shows how components of the Mimi program draw on and develop the seven intelligences of Gardner's theory; figure 2 describes the technology the students study and learn to use as they acquire skills and develop scientific knowledge. Together, these two figures tell the story of why the Mimi program works.

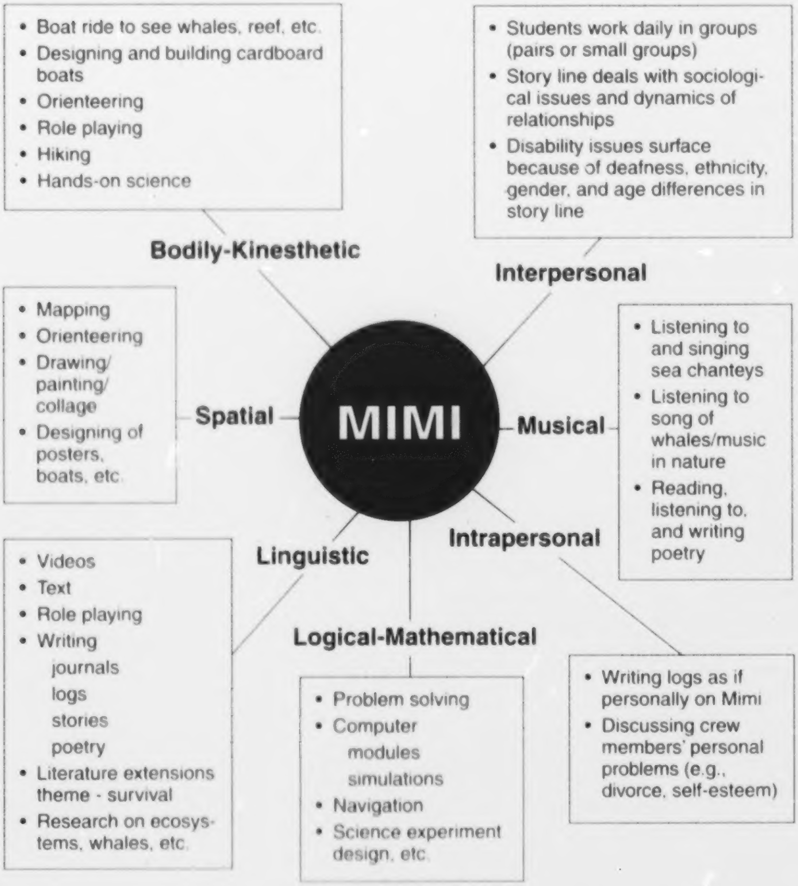
MIMI
Bodily-Kinesthetic
• Boat ride to see whales, reef, etc.
• Designing and building cardboard boats
• Orienteering
• Role playing
• Hiking
• Hands-on science
Interpersonal
• Students work daily in groups (pairs or small groups)
• Story line deals with sociological issues and dynamics of relationships
• Disability issues surface because of deafness, ethnicity, gender, and age differences in story line
Spatial
• Mapping
• Orienteering
• Drawing/ painting/ collage
• Designing of posters, boats, etc.
Musical
• Listening to and singing sea chanteys
• Listening to song of whales/music in nature
• Reading, listening to, and writing poetry
Linguistic
• Videos
• Text
• Role playing
• Writing
journals
logs
stories
poetry
• Literature extensions theme - survival
• Research on ecosystems, whales, etc.
Intrapersonal
• Writing logs as if personally on Mimi
• Discussing crew members' personal problems (e.g., divorce, self-esteem)
Logical-Mathematical
• Problem solving
• Computer
modules
simulations
• Navigation
• Science experiment design, etc.

Fig. 1. Mimi program components and the seven intelligences.

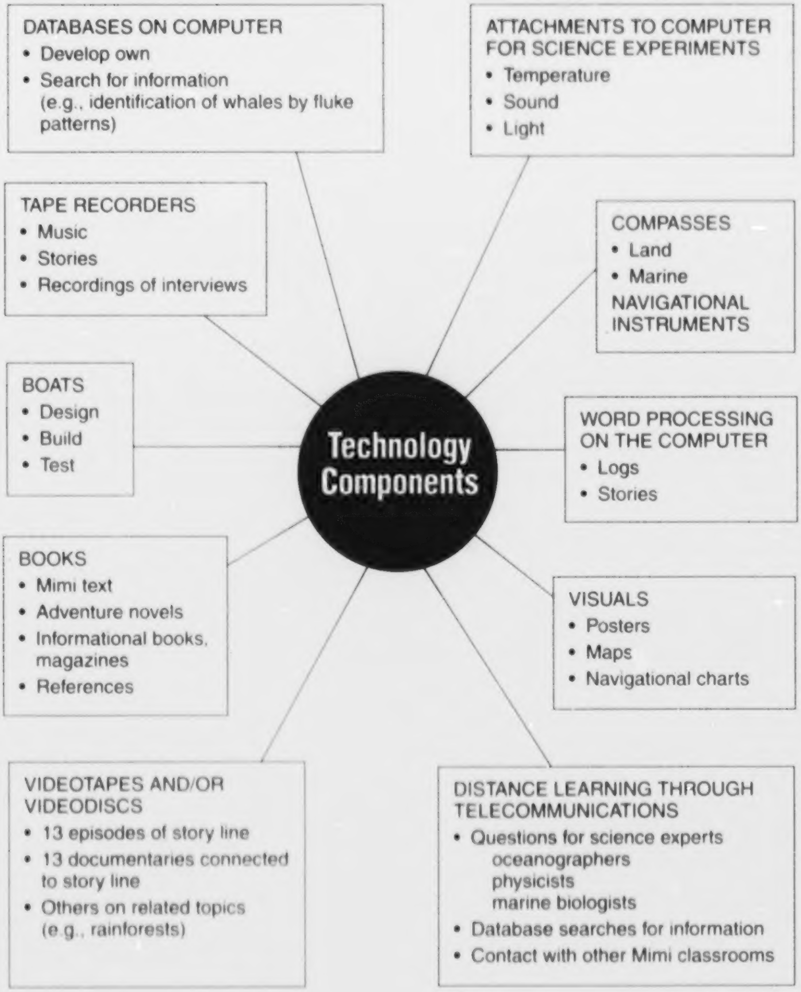
DATABASES ON COMPUTER
• Develop own
• Search for information (e.g., identification of whales by fluke patterns)
ATTACHMENTS TO COMPUTER FOR SCIENCE EXPERIMENTS
• Temperature
• Sound
• Light
TAPE RECORDERS
• Music
• Stories
• Recordings of interviews
COMPASSES
• Land
• Marine
NAVIGATIONAL INSTRUMENTS
BOATS
• Design
• Build
• Test
Technology Components
WORD PROCESSING ON THE COMPUTER
• Logs
• Stories
BOOKS
• Mimi text
• Adventure novels
• Informational books, magazines
• References
VISUALS
• Posters
• Maps
• Navigational charts
VIDEOTAPES AND/OR VIDEODISCS
• 13 episodes of story line
• 13 documentaries connected to story line
• Others on related topics (e.g., rainforests)
DISTANCE LEARNING THROUGH TELECOMMUNICATIONS
• Questions for science experts
oceanographers
physicists
marine biologists
• Database searches for information
• Contact with other Mimi classrooms

Fig. 2 Technology in the Mimi Program.

The technology is an essential part of how the program is able to make learning fun and concepts understandable for children with different learning styles and different intelligences. The carefully crafted, lively, yet educational video episodes and expeditions, the computer with its databases, the hardware for doing science experiments, simulations, and problem solving games are among the things that make this a program suitable for all intelligences. "The combination of media/technologies found in the Mimi program has special power to put math and science concepts and problems in 'real world' contexts that are highly motivating to students."[4]

If the Mimi program were limited to the same story and documentaries but only presented as a print text, there would not be the same level of curiosity, the same powerful context for learning. Even if simulations like the survival problems were given to students, but in print rather than on the computer screen, it would not make this program the powerful curriculum it is. Technology in this program is not just an enhancement, it is integral to the learning.

The experience with technology in the Mimi program has turned my earlier skepticism toward technology into a careful study of what technology and what software will help my students learn and how I can integrate that technology into my curriculum. I now believe that *thoughtful use of technology* can provide different ways for learning and can be used to build upon a child's strength and extend his knowledge and abilities.

Using suggestions from Armstrong, personal experience, and suggestions from colleagues, I've compiled a brief sample list of software and commercially made games that help develop the different intelligences (see Appendix).

A student recently said to me, "I like it that it's not how smart I am, but how many ways I am smart!" YESSS!!! And I have found that quality technology, used thoughtfully and responsibly, invites children to be smart in many different ways!

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**Footnotes**

[1] Gardner, H. (1983). *Frames of mind.* New York, NY: Basic books.

[2] *The Voyage of the* ***Mimi*** was developed by Bank Street College of Education with support from the U. S. Department of Education. Now available from Sunburst.

[3] Armstrong, T. (1993). *Seven kinds of smart.* New York, NY: Penguin Books.

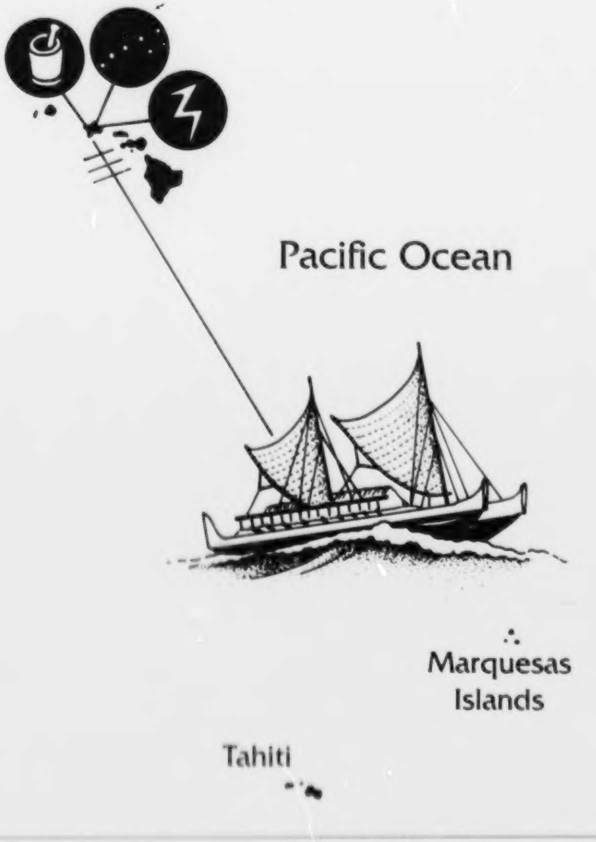
[4] McCarthy, R. (1990). Integrating technologies to enhance learning in science and mathematics. In C. Warger (Ed.), *Technology in today's schools* (p. 96). Association for Supervision and Curriculum Development.

# APPENDIX

A sample of computer software and commercially made games to use in developing the different intelligences.

| Software | Games |
|---|---|
| **LINGUISTIC INTELLIGENCE** | |
| Desktop publishing programs | Scrabble |
| Word processing programs | Boggle |
| Tutorial typing | Trivial Pursuit |
| Story software (e.g., *Reading Magic Library* series) | |
| **LOGICAL-MATHEMATICAL INTELLIGENCE** | |
| Spreadsheets | Abacus |
| Personal finance (e.g., *Quicken*) | Backgammon |
| LOGO | Chess |
| Math problems in story context (e.g., Fizz and Martina kits from Tom Snyder Productions or *Math Mysteries*) | Clue |
| | Dominoes |
| | Monopoly |
| **SPATIAL INTELLIGENCE** | |
| Spatial problem solving (e.g., *Tetris*) | Battleship |
| Clip art programs (e.g., *New PrintShop*) | Checkers |
| Electronic chess games (e.g., *Chessman*) | Chess |
| Graphing and mapping (e.g. *The Graph Club*) | Connect Four |
| **MUSICAL INTELLIGENCE** | |
| Keyboard/computer (e.g., MIDI) | NoteAbility: The Name-the-Song Game |
| Music appreciation (e.g., *Anatomy of Music*) | Simon |
| **BODILY-KINESTHETIC INTELLIGENCE** | |
| *Lego to Logo* | Bottlecaps |
| Motion simulation (e.g., *Flight Simulator*) | Jacks |
| | Pick-up Sticks |
| | Twister |
| **INTERPERSONAL & INTRAPERSONAL INTELLIGENCES** | |
| Electronic bulletin boards | Dungeons & Dragons |
| E-mail | The UnGame |
| Simulations that assign different roles and information to different players (e.g., *The Great Ocean Rescue*) | Scruples |
| | True Colors |
| Software for decision making and critical thinking (e.g., *Choices, Choices* and *Decisions, Decisions*) | GenderBender |
| Family tree software (e.g., *Family Reunion*) | |
| Personality assessment software | |
| Career software | |

# Technology Brings Voyagers into Classrooms*



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* This article was edited by Kristina Inn with assistance from many people. Besides the three teachers whose contributions appear here, a number of individuals generously gave time to provide us with information and technical assistance. We'd like to express our deepest gratitude to Dennis Kawaharada, administrator of educational programs for the Polynesian Voyaging Society; Christina Higa, systems and operations manager of PEACESAT; Dr. Ben Tamura, physician and coordinator of the *'awapuhi* experiment onboard *Hōkūle'a;* Tom Chun, Kamehameha Secondary School science teacher and past member of a voyage.

The Kamehameha Journal of Education (Summer 199[illegible]), Vol. 6, 15-30

# Introduction

Late in the afternoon of February 11, 1995, voyaging canoes *Hōkūle'a* and *Hawai'iloa* set sail from Hilo Harbor amidst chilling northerly winds on the start of their three-month, 6000-mile voyage to Tahiti and the Marquesas Islands and back. This historic voyage will be remembered, not only as the first long voyage made in recent history by a canoe built of traditional materials, but also as what Nainoa Thompson calls "a voyage of education."

This was a voyage in which students learned about ancient voyaging methods through very modern, hi-tech means. Through modern technology, thousands of school children across the nation were able to monitor the progress of the canoes and learn from the experiences of crew members. Students heard live radio broadcasts from Chad Baybayan, navigator of *Hawai'iloa*, and Nainoa Thompson, master navigator aboard *Hōkūle'a*. They followed daily satellite tracking of the canoes' actual positions and compared them to the navigators' own estimations relative to the course they had plotted out before the start of the voyage. They accessed the Internet on their computers for background information and updated accounts from the canoes. They talked directly with the navigators and crew members and exchanged questions and answers. Students in places as far away as Maine watched students at a television studio in Honolulu converse with crew members and engage in various activities concerning wayfinding. In these and other ways, the art of navigating without modern instruments was brought to life by instruments as modern as single-side band radios, computers, fiber-optic cables, and satellite communications.

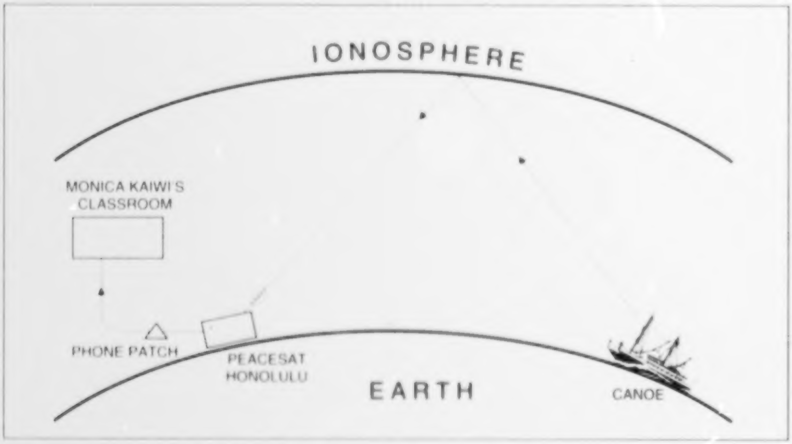
Following are three articles that focus on some of the many activities that have been inspired by this voyage. The first article is an excerpt from one of the conversations that took place between a class of high school seniors and Nainoa Thompson. The second article describes one of the experiments that crew members helped to carry out onboard the canoes. The last article looks at some of the activities an eighth-grade science class did in conjunction with the voyage.

Kristina Inn
Associate Editor

# A Conversation with *Hōkūle'a*

*Monica Kaiwi, Kamehameha Secondary School English teacher, teaches a course on literature of the Pacific for high school seniors. Having had "the privilege" of working closely with the educational end of the Polynesian Voyaging Society, Monica "gives back" by helping out on the docks. On Saturdays, she can often be seen at the pier, together with several of her students, sanding and caulking the canoes or packing food and preparing for a sail.*

For the last two years, Monica Kaiwi has integrated the study of voyaging into her course on literature of the Pacific. This year, her curriculum was enhanced by the voyage to Tahiti. Her students were able to schedule several live, interactive sessions with master navigator Nainoa Thompson aboard *Hōkūle'a* on its way across the Pacific Ocean. Voice communication between canoe and classroom was made possible by single-side band radio technology: Signals transmitted from a radio and an antenna on the canoe were received by the classroom through a telephone connection via PEACESAT Honolulu.



The canoes were equipped with a radio and an antenna, which transmitted and received signals reflected off of the ionosphere. PEACESAT Honolulu established daily radio schedules with the canoes on frequencies ranging from 5 MHz to 18 MHz. Students were connected to crew members on the canoes by a telephone connection and phone-patch via the single-side band radio at PEACESAT Honolulu. (Information and sketch courtesy of Christina Higa of PEACESAT.)

To prepare for these conversations, the students generated a list of questions, which Monica posed to Nainoa at the scheduled hour. Here we cut in on one of these sessions.

**PEACESAT:** *Hōkūle'a,* … PEACESAT. [Muffled sounds mixed with a great deal of static.]

You're dropping below readability. Maybe we should try 12 MHz again. [Voice on the other end is still muffled and words indiscernable.]

Okay, you say 13, channel 6, is that correct? [Words are still indiscernable.]

Why don't we switch to 6 to see if it's any better. [Static continues.]

This is PEACESAT … I don't read you any better. In fact, there's more static on this one. Maybe four is the best.

***Hōkūle'a:*** I'll be picking up 4 xxx[static], 13 meg. Over.

**PEACESAT:** There's more static, but you're more readable. Let's try this one for a while.

What do you think, Kamehameha? Is this more readable for you?

**Monica:** We're hanging in here. Over.

**PEACESAT:** Okay. Go ahead.

A feeling of relief pervades the room as Monica Kaiwi's class proceeds to talk with Nainoa.

**Monica:** What kind of qualities do you look for in a crew member? Over.

**Nainoa:** Well, among other things, they need to pass certain medical requirements, be physically fit for the voyage and mentally stable to handle the kind of conditions out here. One of the main qualities we look for is individuals who are able to work well with each other, people who can support each other. Over.

**Monica:** What happens if there is a conflict? How do you solve problems that you may have with different personalities? Over.

**Nainoa:** You know, Monica, I've been sailing for years, maybe 50,000 miles, and we very seldom had any of those kinds of personal conflicts. Mainly what we try to do is if there are individuals that have problems working together, it's really up to the captain or navigator to talk to the individuals.

What you need to focus on is the objectives for the whole. You know, these canoes are not just sailed by those that are on board; they're sailed really by all those people who cared for the canoe, for those many volunteers in the community who are still at home. Those who are privileged to sail on these two canoes really are just representatives of the community as a whole. And considering all that they represent, they [the crew members] need to look at the goals and objectives of the organization and place the needs of everyone else above themselves. Over.

**Monica:** How do you take care of the canoe? Do you check every day or every few hours to see how the canoe is holding out and just making sure everything is intact? Over.

**Nainoa:** We have what you call a watch system where we rotate members who are on duty to take care of different tasks, whether it's steering or maintenance of the canoe, cleaning, or cooking. And that watch system changes every four hours. Every time we change, we check—these hulls, the weighings, the sails, everything that needs to be maintained on the whole trip—so it's done about every four hours. Over.

. . . .

**Monica:** How would you handle a storm, especially since you're in the rain right now; if it gets worse, what are your plans? Over.

**Nainoa:** Assuming a storm comes in, the biggest concern is the strength of the wind and the size of the ocean swells. If the winds get really strong, sometimes we need to put a sail down because we can't have all that stress in the wings (referring to the sides of the canoe, which represents *manu*, or the bird, searching for land). So when this rain came, it came right at dawn, the first sight of dawn, and we had to close our sails and then feel the wind and to be inside the rain. But normally, we just watch for the ocean position and the weather conditions; with strong winds and big waves, we normally put our sails down and wait for the conditions to get better. Over.

. . . .

**Monica:** How fast are you going right now? Over.

**Nainoa:** Stay on the line and I'll take a look. [Goes off to check, then returns.] Generally, we're going up 1½ to 2 nautical miles per hour. Over.

**Monica:** How are you able to measure that? Did you drop something in the ocean and measure the time passing? Over.

**Nainoa:** I just kind of looked at the ocean as it passes by the canoe. It just comes with a lot of experience. Over.

**Monica:** Are you noticing any strong currents that are moving the canoe? Over.

**Nainoa:** Yeah, when the wind is quiet, it's very, very difficult to read the currents; it's almost impossible to see … which way the water is moving, so it's very difficult. But what we do is we observe and keep track of the ocean swells, the different waves, the patterns of moving swell … Over.

**Monica:** How many swells can you identify at the same time? Over.

**Nainoa:** That's hard to say. It depends on the character of the wave. I'll put it this way: when there's less swells, it's easiest to read; you're not trying to keep track of too many. But like yesterday, the wind was swishing around, so it was making swells in many different directions; then it's very, very difficult to read. There must've been at least a swell from most of the major directions—north, south, east, and west. But today, the most dominant swells are from the north, the southeast, and the northeast. So we're just trying to keep track on three directions. Over.

**Monica:** [to students] Any other questions? [to Nainoa] I think we're out of questions. Do you have any closing thoughts or comments, or even an assignment that you would like us to conduct until the next week? Over.

**Nainoa:** What I would really appreciate is if there's anything that you folks want and that we can help you by conducting any kind of research project or experiment out at sea, that's possible. We just want to help you folks with your learning if we can. If there's anything that you're interested in doing with this, we'd really like to help out. Over.

**Monica:** Thank you very much for your time. We really appreciated learning so much and hope everything continues to go well. Over.

**Nainoa:** Okay, Monica, give my best to all the students. I'm very glad to be able to talk to you folks, and I look forward to talking to you next week. Over.

# The *'Awapuhi* Experiment

***Joel Truesdell,** Kamehameha Secondary School science teacher and director of the Kamehameha Summer Science Institute, takes his students through a unique process that combines the study of modern methods of scientific analysis with the study of native Hawaiian medicine and healing practices. Each year, a number of his students' projects are selected to represent the state of Hawai'i at the International Science Fair. Here, Joel talks about an experiment one of his students,* ***Nova Suenaga,*** *conducted onboard the voyaging canoes with the help of crew members.*

For the last five years, students in our science research program have done chemical and microbiological analyses of Hawaiian medicinal plants. They study college-level chemistry, microbiology, and botany; and for three weeks, they do intensive research on Hawaiian medicine and healing practices. They then design and carry out a project in which they examine traditional Hawaiian medicine in light of modern Western scientific analysis.

In the spring of 1993, Pinky Thompson asked if I could get any of our students interested in what he considers the three biggest problems they have on these voyages: constipation, ocean sickness, and skin problems related to the irritation caused by clothes continuously rubbing against skin covered with salt from the salt water.

For the last two years, we have been working on two of these problems: ocean sickness and skin irritation due to constant exposure to the sun and the ocean salt. Cindy Richardson has been studying the skin problem. She'll be trying out *kukui* nut oil, because the main thing we wanted was a substance that is oil-based rather than water-based, something the salt water wouldn't wash off. We'll be testing that one on the journey back.

Nova Suenaga is working on the problem of ocean sickness. Our quest was to find something that would pass the tests of scientific analysis and cultural authenticity, something that would satisfy the chemical and microbiological requirements for treating ocean sickness as well as be culturally and historically accurate. That meant the plant had to be Polynesia-based or indigenous; in other words, it could not be alien or introduced after Captain Cook, because, then, it could not possibly have been part of the original voyage. The plant could not be found only in the Hawaiian

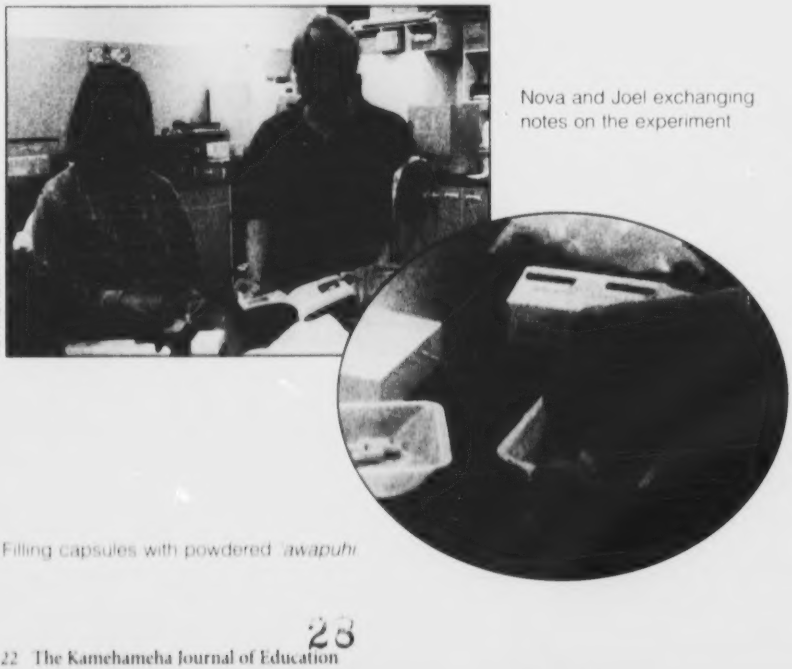
Islands, because that would also have excluded it from being part of the original voyage. And we had to find reference to or contact with traditional healers who stated that the plant was indeed used for motion sickness.

Nova finally settled on *'awapuhi,* commonly known as shampoo ginger. Her decision was bolstered by a study that had been done on Chinese ginger and its effect against motion sickness; and Chinese ginger is a real close relative of *zinger zerumbet* or *'awapuhi.*

Nova took the root, dried it, then powdered it. And for scientific purposes, she put it into capsules: roughly a quarter of a gram per capsule. In the study of Chinese ginger, the researchers used 250-mg capsules and had their subjects take two capsules every four hours. Using this study as a guide, Nova tested the use of two 250-mg capsules four times a day on a voyage to Kaho'olawe. She got 90 percent effectiveness for the people who are prone to motion sickness; of course, that was just a short trip.

She repeated this experiment onboard the canoes on their way down to Tahiti. Dr. Ben Tamura, the presiding physician, was himself prone to motion sickness and, thus, became a subject of the experiment along with three other crew members. Dr. Tamura did not get sick at all on the trip.

One observation Nova has made with the data collected thus far is that all the people for whom the *'awapuhi* didn't work were women, suggesting



Ramona Newton Hao

Nova and Joel exchanging notes on the experiment

Filling capsules with powdered *'awapuhi* that the plant doesn't seem to be as effective with women. Other variables have come into play since the start of this experiment. According to Papa Henry Auwae, a recognized resource in the proper use of Hawaiian medicinal plants, we should have used *'awapuhi* from the Big Island, because the potency of the plant found on O'ahu has been greatly diluted. I will be paying a visit to Papa Henry this summer and hope to learn more about this.

Based on some research findings, we decided to make a change to the experiment for the return voyage. Instead of using pure *'awapuhi*, we are testing a mixture of 225-mg of *'awapuhi* and 25-mg of *'awa*, which is known to act as a kind of relaxant. One explanation of motion sickness is that it is partly due to fear; nausea arises as stomach acid develops from a feeling of fear combined with motion. The researchers in the Chinese ginger study also alluded to the possibility that the ginger helps absorb a lot of the stomach acid. So we are hoping that the addition of *'awa* will help to relax the person and lessen stomach acid.

# Learning from the Voyage

*Barbara Culliney is an eighth-grade science teacher at Kamehameha Secondary School. This article is based on a conversation with Barbara in which she talked about her multidisciplinary approach to teaching science.*

The voyage of the canoes this spring gave us a framework for organizing a variety of lessons. Some lessons, based on background materials I had collected over the years, were planned ahead of time. Other lessons took advantage of what was happening to the canoes at a particular moment. For instance, using the daily position reports published in the newspapers and reported on the radio, we might do an activity on latitudes and longitudes and ocean currents. Or we might pick up on something a crew member said about life onboard the canoe—what it might be like to sail through the doldrums, for example. Over the course of the unit, we touched on oceanography, meteorology, astronomy, physics, anthropology, archaeology.

First, I wanted to give the students some background to the whole voyaging effort—why was it done originally? After all, we do know how to sail using compass, sextant, satellite fixes, and other modern equipment; what is the point of sailing in a traditional way?

So we needed to go back to the 1940s, to some of the theories about where Polynesians originated. We studied a little bit about the *Kon Tiki* and Thor Heyerdahl's hypothesis about the Polynesians originating in South America. We talked about David Lewis and Ben Finney and some of their early attempts to build traditional-styled crafts and to sail using traditional techniques, maybe more in line with the Micronesian culture. Then we did a lot of background reading about *Hōkūle'a* and its vision to rediscover the original voyages of the Polynesians—in a sense, to put to the test, perhaps even to put to rest, some of the earlier hypotheses.

This reading, I think, helped the students appreciate better what was going on with the voyaging efforts. They could see the significance of this endeavor to their Hawaiian identity and cultural heritage. So, even though we know how to sail with compass and sextant, it's important to pass down the techniques of traditional navigation as one way of keeping cultural traditions alive.

For me as a science teacher, the Polynesian voyaging vision provided another benefit—it was a way to show the scientific method in action.

Sometimes students get the idea that scientific testing goes on only in a laboratory. Well, the laboratory for the question, Where did the Polynesians originate? was the Pacific Ocean. The individuals who had this vision believed Polynesians did not populate the Pacific by accident but embarked on purposeful migration—this was the hypothesis. They built the *Hōkūle'a*, tested the idea that such a canoe could sail long distances using methods similar to those of the ancient Polynesians, and showed that purposeful migration to Hawai'i indeed could have happened, and probably did happen.

From readings on the traditional art of navigating or wayfinding, students learned how the navigator memorizes where certain stars or constellations rise and set at different times of the year and how, from that memorized knowledge, he knows the position and direction the canoe is going. These readings led us naturally to the study of celestial bodies.

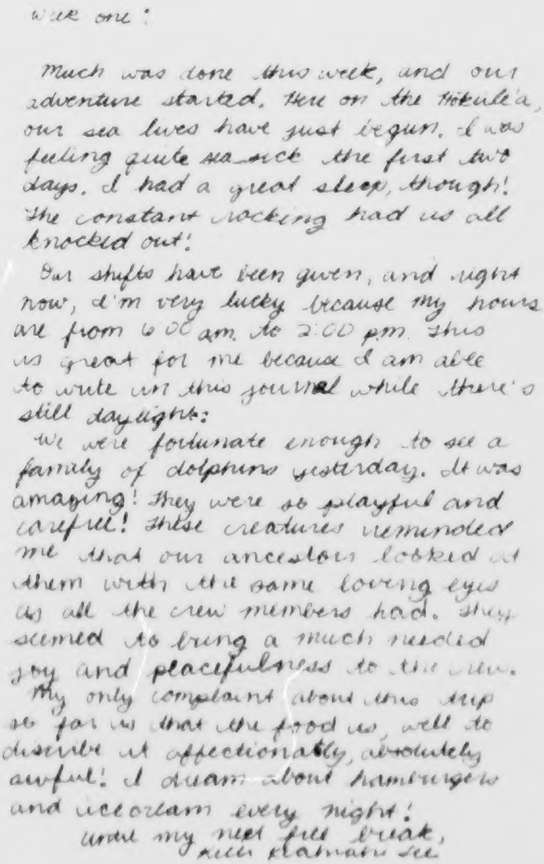
For each student, I obtained a map of the night sky with all the constellations and bought some luminous, glow-in-the-dark paint that you can get at a craft or hobby store. Then, on their sky maps, the students painted in the stars of the different constellations, at least of the major ones, such as Orion, the Big Dipper, the Little Dipper, Cassiopeia, and maybe they also did Leo. They took the sky map home, and their assignment was to go out every night over a period of a week or two and see if they could locate the stars. In this way, they were able to see how the position of the stars change—if you go out at 8:00, they're in a certain position; if you go out again at 9:00 or 10:00, they've moved further to the west. So I think the students got a sense of what it is like to be a navigator, to be out on the deck of a ship and looking up at the sky. Some of them wondered why they couldn't see the Big Dipper. Well, of course, for those who are living in, say, Hawai'i Kai, the Ko'olau Range would be between them and the northern horizons.

As the canoes were sailing, we kept up with them by way of the Internet reports, which we printed out. These reports gave us updates on what was happening on the voyage, how crew members were maneuvering the canoes, what life was like on the canoe, and so forth. Now I thought it was time to get into sailing physics and sailing vocabulary so that when the voyagers talked about "tacking" or "sailing before the wind," the students would have some knowledge of what that meant.

This lesson turned out to be a lot of fun. Tom Chun, physics teacher in our high school, came to our class and brought what he called "skateboards." They weren't the skateboards that teenagers think of. They were two-by-four blocks of wood with skate wheels and a dowel rod attached to the middle of the board. The dowel rod represented the mast, which had a sail made from a thin block of styrofoam that could be positioned at different angles. He brought a number of these little crafts to our class and four huge electric fans—really powerful, huge fans. The students were able to "sail" these little rollerskate things back and forth and get a sense of what sailing is all about. In the process, Tom introduced them to some basic physics terminology and concepts such as vectors.

Since scientists use journals to record their observations, I gave my students an opportunity for extended journal writing. The students were to write about what it was like to be onboard one of the sailing canoes during the very first week. As we got further into the unit and the students had more information about the voyage and voyaging, they wrote as if they were a navigator recording his experiences. Here, I include journal entries from two of my students' journals.

**Journal entries from Kelli Lee:**



Week one:

Much was done this week, and our adventure started. Here on the Hokule'a, our sea lives have just begun. I was feeling quite sea-sick the first two days. I had a great sleep, though! The constant rocking had us all knocked out!

Our shifts have been given, and right now, I'm very lucky because my hours are from 6:00 a.m. to 2:00 p.m. This is great for me because I am able to write in this journal while there's still daylight:

We were fortunate enough to see a family of dolphins yesterday. It was amazing! They were so playful and carefree! These creatures reminded me that our ancestors looked at them with the same loving eyes as all the crew members had. They seemed to bring a much needed joy and peacefulness to the crew.

My only complaint about this trip so far is that the food is, well to describe it affectionately, absolutely awful! I dream about hamburgers and icecream every night!

Until my next free break,
Kelli Kamanu Lee

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Dear Journal,

Today went by so slowly! I had long hours and shifts, and we had to collect rain water and fish for about two hours.

We were fortunate enough to recieve some calls from the people who are interested in the Hokule'a, but unfortunatly, I was too tired to take time off from my sleeping shift to talk to them.

We are supposed to be heading into "the doldrums", but this year it seems as if it doesn't exist! I'm actually a little disapointed about that because that's when the crew has time to relax and enjoy the sea.... above all we bond together more. The doldrums are to us like our vacation... and we missed it.

Oh, wait! The reason we are collecting rainwater is for some students that want to do experiments on the pollution levels found in the water. I hope it turns out okay.

Well, until I write again,

Kelli Keahiahi Lee

Dear Journal,

It has been a long journey, but we finally spotted land! Oh my gosh, I was so excited! After our painstaking journey and endless hours of hard work, we finally made it to Tahiti!

The Tahitians greeted us with such tenderness and happiness we were all very grateful to them. They prepared delicious foods and entertained us as we feasted.

I was so happy to finally get on shore I can't explain it. I love the ocean, but I surely believe enough is enough...

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I learned so much during my voyage; I'm really upset that I have to part with my newly found friends. If given the opportunity, I would definitely do this again.

Hopefully till my next
journey,
Keith [illegible]

## Journal entries from Valerie Ululani Ho:

February 11, 1995 Day 1

Well, here we are, on the Hawai'iloa, our first evening out of Hilo. The Ho'olua (northerly) winds are blowing at 10-20 knots and gusting higher. It's rather chilly. The seas are at 4-8 feet.

The crew and I have good feelings about this voyage. While the wind is cold, the atmosphere aboard the canoe is warm and happy.

As the sailing crew of the No Nā Mamo expedition did, we are trying to help young Hawaiians learn about their voyaging heritage. We are planning to try to radio two classes a day. Later on in the voyage we also plan to radio the Kamehameha Schools

Preparatory Department, where Brad Cooper works. There are several classes at the school where the students will be following our progress and that of the Hōkūle'a. It's really too bad the Makali'i is still in testing, because it would be interesting to have us all sailing at once.

The wind is in our sails. This voyage promises to be an adventure!

Day 20 March 2, 1995

We're close to land. Bruce and I have seen several noio, and even though we haven't sighted any land yet, I know we can't be far.

We are currently sailing towards Haka Malanae. It's cloudy tonight, so we're navigating by swells instead of stars. We ought to be in Tahiti by this weekend. Everyone is looking forward to ice cream and clean clothes once we land. I must admit, I wouldn't mind some of that myself.

Bruce and I have sighted land debris. As of now we also have three noio sitting on the starboard hull, and more flying around us, sort of like an early morning escort. There's going to be a lot to say about them when we get into Pape'ete

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March 5, 1995

It feels strange to be on land again after the voyage. I'm so used to the canoe that it seems odd to be walking on a surface that doesn't sway.

I've finally got clean clothes, something I've been looking forward to, along with a huge banana split and a shower. One can only stand so much fish and seasoap baths.

We had a big welcome at Pape'ete After we get some rest, we're going to start repairs on Hawai'iloa for the return voyage. Makali'i will be joining us for the second leg.

We've been talking to the crew of the Hōkūle'a, and everyone is pleased with the results of the voyage. May there be many more to come.

# Technologies Old and New: Teaching Ancient Navigation

## Simon Spalding

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***Simon Spalding*** *is a freelance educator who presents maritime history at museums, historical sites, and schools throughout North America and Europe. He also performs at maritime and folklore festivals and has recently completed a recording of Scottish maritime music. His ongoing projects include a translation of Søren Thirslund's History of Navigation from Danish to English and a series of children's maritime historical novels.*

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I teach the history of the sea, ships, and maritime communities;[1] some of my programs present the evolution of navigational practices. Whenever possible, I use the technologies available to the seafarers of former times. My students use facsimiles of old instruments and tools to collect and interpret navigational data. Below, I describe some of my methods.

*Dead reckoning* is a procedure for wayfinding when out of sight of land, using measurements of time, direction, and speed to estimate a vessel's position in relation to a known previous position. To illustrate the principles of dead reckoning, I bring into the classroom facsimiles of the devices used by seafarers in the sixteenth and seventeenth centuries: sandglass, chip log, compass, and traverse board.

The sandglass measured time. To measure the speed of a ship, a special, half-minute sandglass was used together with a chip log, a piece of wood attached to a knotted line. The distance between the knots in the line was 48 feet, which is approximately the same fraction of a nautical mile as a half-minute sandglass is of an hour. The chip log was thrown overboard, and the number of knots "payed out" in the time it took the sand to fall—as the ship moved away from the floating chip log—indicated how many nautical miles per hour the ship was traveling. A nautical mile per hour is still called a "knot" to this day. (The chip log was in use by the third quarter of the sixteenth century. By the eighteenth century, mariners had

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discovered that the customary distance between knots corresponded to a sandglass of 28 seconds, and so a 28- or 14-second glass was used thereafter.)

I show the students an actual chip log and demonstrate how it was used by moving a model boat away from the chip log.

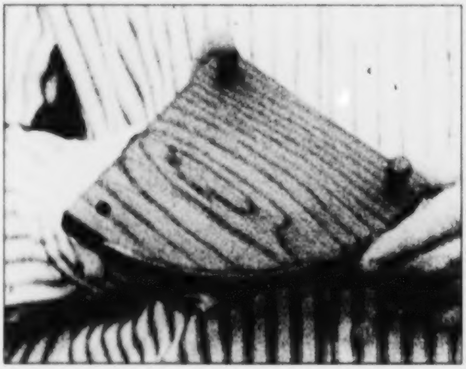


Photo courtesy of Simon Spalding

A chip log of oak and lead, without its knotted line.

Direction was measured by Medieval mariners with a magnetic compass. I pass around a facsimile of a sixteenth-century ship's compass for the students to handle. This is worthwhile because a ship's compass, then and now, differs from the normal landsman's compass. In a compass designed for shoreside use, a magnetized needle floats over a compass rose affixed to the compass itself; in a mariner's compass, the needle is fixed to the compass-rose card, while the rest of the compass moves with the ship. A rhumb line on the mariner's compass shows the vessel's orientation.

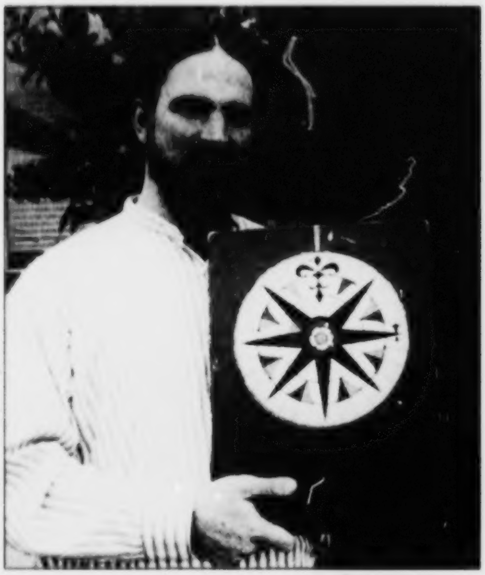


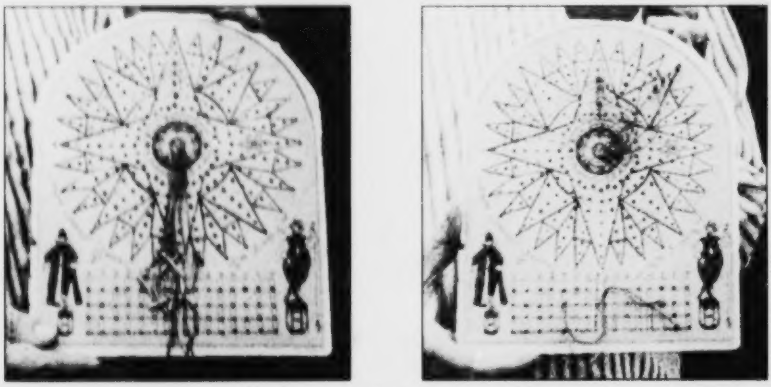
Photo courtesy of Simon Spalding

My "compass board." The compass card design matches that of the card on the facsimile compass. The card on the board may be rotated from behind. Students read the "bearing" of their imaginary ship by observing which of the 32 compass points is closest to the "rhumb line" painted at the top of the board.

Once students understand the methods for measuring time, direction, and speed on late Medieval European vessels, I let them practice dead reckoning by using a combination of traditional devices and devices I've developed myself. For students to be able to experience what it was like to navigate in past centuries, I have constructed a board with a revolving compass rose. This board allows me to show the whole class an imaginary ship's bearing from a vertical orientation and to change the bearing at will.

I divide the class into four "watches": each is to imagine sailing a vessel for four hours. (We "compress" time so that what would take four hours in real time requires only fifteen minutes or so of class time.) The students in each watch take turns being "helmsman," recording the ship's bearing and speed every (compressed) half-hour. The students record their "data" on a facsimile of a traverse board, a device used from the late Middle Ages through the early nineteenth century to facilitate record keeping by seafarers, many of whom were illiterate.

The traverse board is a plate of wood with a compass rose on it. Superimposed on the 32 rhumbs (direction lines) of the compass rose are eight concentric circles, each representing one half-hour glass in a four-hour watch.[2] The traverse board has holes at the intersections of rhumb line and circle. Every half hour, the ship's bearing is recorded by placing a pin into the hole which corresponds to that half-hour of a watch (one of the eight concentric circle) and the ship's direction (one of the 32 rhumb lines). Along the lower edge of the traverse board, there are additional pins and holes, laid out in a grid pattern, for recording the vessel's speed.



Photos courtesy of Simon Spalding

Left: Traverse board, ready for use. Right: Traverse board, after use. The placement of pins shows the following: Glasses 1-4, bearing North, speed 4 knots. Glasses 5-6, bearing Northeast, speed 5 knots. Glasses 7-8, bearing Northeast, speed 6 knots.

The students take turns recording time, direction, and speed during their watch, practicing what they have learned. At the completion of the watch, I guide them through "working a traverse." Multiplying speed by time to estimate distance covered on each course, the students estimate distance and direction during the vessel's imaginary four-hour sail.

Letters students have sent me after my visits to their schools show that they retain a great deal about the principles of dead reckoning. I doubt that they would remember so much had they not practiced on a facsimile of the very device used by European mariners centuries ago.

To teach about the principles of *celestial navigation*, I again use the technologies in existence during the Middle Ages and Renaissance. Medieval astronomers demonstrated the motions of the Sun, Moon, and planets with the help of an orrery, a moving model of the solar system. I use a globe, marble, and small model ship in the manner of an orrery to demonstrate the spatial relationship between a ship traveling on the Earth's surface and the North Star or the Sun.

As with dead reckoning, the students practice what they have learned with facsimiles of late Medieval instruments. They measure the angle of an imaginary pole star in the classroom with a simple plumb-line quadrant, and they go outdoors to measure the Sun's angle with an astrolabe. The feedback I have received from students and teachers indicates that this hands-on experience is an enormous aid to memory.

Photo courtesy of Simon Spalding

Mariner's astrolabe as used when taking a star sight. The observer adjusts the alidade to center the star in both pinules, while the rest of the astrolabe hangs plumb.

Last year, I worked with the students at Kamehameha Elementary School. I was asked to discuss not only the methods of traditional European navigation but also the navigation techniques of pre-contact Polynesia. This was a welcome challenge. Besides studying available literature and present practices of traditional Pacific cultures, I realized that I needed to explore new technologies for my classroom presentations.

Before describing what I did with the Kamehameha students, I should clarify that much of our supposition of pre-contact Hawaiian

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navigational practice is based on surviving techniques in Micronesia and Santa Cruz Island. I wished to avoid taking sides in ongoing debates on the techniques and information-processing conventions of navigation among the ancient Hawaiians. Therefore, I shared with my students which elements of navigational technique currently practiced on Hawaiian voyaging canoes are derived from living Micronesian tradition and which have been developed empirically in recent years.

Among other techniques, I presented the Micronesian method of tacking to find or intercept an island, processing information by imagining the island to "move" under a fixed visual reference point. I also presented the technique of locating an island or shoreline by the reflection or deflection of swells. These may have been used by the ancient colonizers of Hawai'i. I was on surer ground with the use of the rising and setting positions of stars as a "star compass," since something like this was described in an article on astronomy lessons in a Hawaiian-language newspaper from the mid-nineteenth century.

In presenting the traditional navigation of indigenous Pacific peoples, I wanted to show how different cultural and environmental conditions produce different techniques and technologies. We discussed the relative merits of oral and written transmission of knowledge. We explored the mixed blessings of specialization that written transmission fosters: a traditional Micronesian navigator holds in his memory a great deal more of his culture's astronomical and environmental knowledge than most European navigators.

Each generation of Micronesian navigators must pass on to its successors the total body of its knowledge, which must be committed to memory and passed on to the next generation. Since the appearance of written "rutters" in the Middle Ages, the European tradition has relied more on written information, to which the navigator may refer while under way. The European-style navigator has placed more and more reliance on his tide tables, charts, solar and star declination tables, and instruments.

We discussed how similar environmental conditions can encourage similar techniques in distant corners of the world. For example, the observation of swell patterns reflected or deflected by nearby islands is not only a Micronesian technique; until recently it was used by Shetland fishermen, who frequently put out to sea without a compass. This Shetland technique may have been handed down from ancient Scandinavian practice.

We also discussed how different environmental conditions can foster quite different techniques and technologies. An example is the use of stars for determining latitude or bearing. While indigenous peoples of the Pacific have made extensive use of the rising and setting positions of stars as a star compass, European techniques have focused on the horizon angles of the stars and the Sun. (Horizon angle is the distance in degrees from a celestial body to the visual horizon.) The difference probably results from the fact that in the Tropics most stars rise and set, following a nearly vertical path near the horizon. In Europe, most stars circle the celestial pole without rising or setting; even those stars which do rise and set follow angled paths near the horizon, making them poorly suited for orientation as part of a star compass.

How could I demonstrate to students these differences in the movements of the stars? After some thinking and experimenting, I decided to adapt a home planetarium, designed by George C. Atamian, marketed commercially as a "Star Theater." This device, available from mail-order catalogues and toy stores, uses a tiny halogen bulb at the center of a clear plastic globe. Stars and constellations are printed on the globe. When the bulb is switched on in a dark room, the constellations are projected as dark points on to the walls and ceiling that are lighted up by the Star Theater.

In order to adjust the angle in which I projected the constellations, I removed the Star Theater from its base. I also removed the horizon ring because I would be changing the angle of the "celestial pole" projected on to the classroom walls and ceiling. Having darkened the classroom as much as possible, I held the Star Theater so that the North Celestial Pole was projected about 10 degrees from the horizon, and I slowly turned the Star Theater to show the rising and setting of stars in the Tropics. Then I pointed the Star Theater at an angle of 60 degrees, and again slowly turning it, I showed the motions of the stars as seen in the skies of northern Europe in spring and fall.

The students appeared to grasp instantly the difference in the motions of the stars in the two latitudes, a concept they probably would not have understood had I tried to get it across with words only.

In conclusion, I would like to stress that applications of technology to the classroom need not be limited to computers and CD-ROM. In presenting the development of navigation by European and Pacific peoples, I found that some of the most useful technologies were simple analog instruments developed centuries ago for information storage and retrieval and for celestial observation. A commercially available device that combined a clear plastic globe with a flashlight battery and Micronesian concepts for processing changing spatial relationships were helpful also. When presenting complex spatial and temporal relationships, analog and even ancient technologies still have a place in the classroom.

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**Footnotes**

[1] In November 1994, I spent five days teaching maritime history at Kamehameha Elementary School and another two weeks at public schools in Kailua, Lahaina, and Hilo. Some of my programs dealt with the music of sailors who visited Hawai'i in the eighteenth and nineteenth centuries, others with whaling in the Pacific and the mutual influences of Hawaiian and maritime cultures. The most challenging course, by far, was one that compared and contrasted the art of navigation in Europe and in parts of the Pacific.

I am very grateful to Kamehameha Schools and to my hosts on Maui and the Big Island for giving me the opportunity to expand, develop, and try out new techniques in their classrooms. My special thanks go to Kahele Kukea of Kamehameha Elementary School, Sandy McGuinness of the Maui Philharmonic Society, and Judy Wakely of the Hawai'i Concert Society in Hilo.

[2] Half an hour was the customary duration of a ship's sandglass and four hours the customary watch or work shift. This division of time still survives in the system of bells used to mark time on naval vessels.

## For Further Reading

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# That's a "Wrap"

## Patricia Gillespie

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***Patricia Gillespie,** a Master of Fine Arts in theatre education, has been teaching television productions at Kamehameha Secondary School for six years. As a curriculum developer for the Hawai'i International Film Festival, she helped develop the prototype interactive multimedia program that accompanied the Indonesian film* My Sky, My Home. *She feels the new technology presents exciting learning opportunities for young people and is dedicated to using the power of media to promote cultural understanding.*

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The blare of the 20th-Century Fox fanfare rises from the computer. It's 2:41 p.m. and students have five minutes to put away their equipment before the period is over. The beginning students have been shooting their single-camera film style projects. One group is shooting a rap cooking show. They put on their costumes, set up their props, but then faced a bad cable on the remote microphone. After fixing it, they had to wait until the group in another part of the studio finished playing music for their commercial. However, now it's time to break down. Oh well, Kanani says she will try to get her technical crew to set up a little faster tomorrow.

Layne, in charge of publicity and sales for the Senior Video, hands me a very professional looking list of names, addresses, homerooms with the number of videos bought. He has entered all this information into the computer. I'm impressed! I ask him how far along he is with his interactive multimedia science project. He says he needs to scan some more pictures into the computer.

Mel and Kristi have finished their project on the soccer team, and Mel announces she wants to do a music video on "couples and love." She hands me her *treatment* (a narrative of her ideas), typed. "Wow!" I say. "This looks great!" She asks if she can *chromakey* (a method of electronically inserting an image from one video into another video) a scene tomorrow during 6th period. I say, "Yes, but Chris [our technician] will be at lunch, and I have a meeting. No one will be able to help you." She says, "Don't

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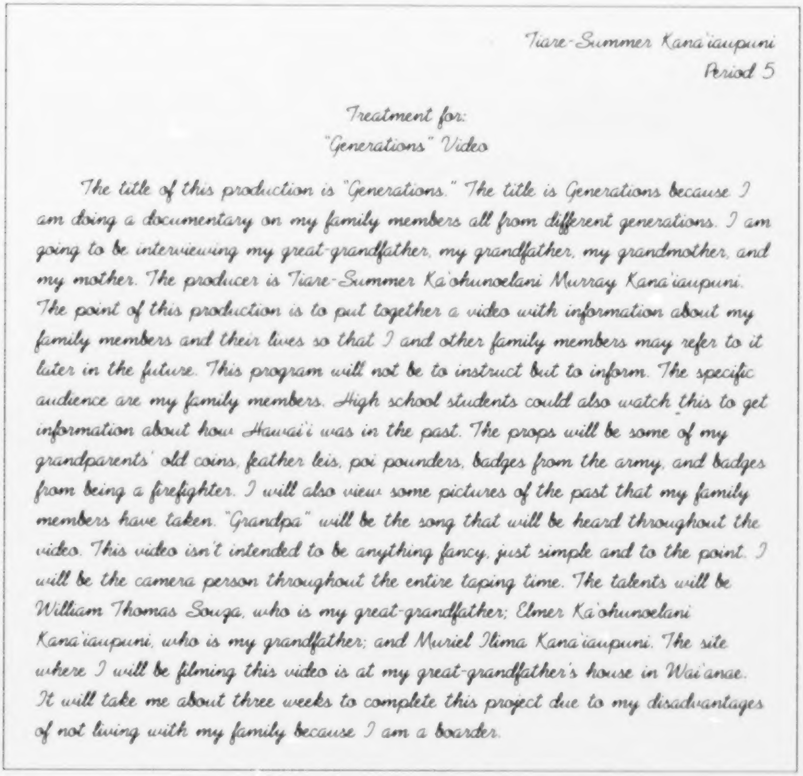
worry. I know how to work everything." I'm delighted. She's only a freshman and already has acquired all these skills; and she's going to be around three more years!

Tiare says she wants to tape her parents this weekend for her family history documentary called *Generations*—she has already given me her treatment (see fig. 1). It's a long weekend, and she's going home to the Big Island. I tell her to be sure to take a remote mike so she can get good sound. She says she is afraid she won't be able to get it to work. I suggest she schedule time with Chris so he can give her some pointers.



Tiare-Summer Kana'iaupuni
Period 5

Treatment for:
"Generations" Video

The title of this production is "Generations." The title is Generations because I am doing a documentary on my family members all from different generations. I am going to be interviewing my great-grandfather, my grandfather, my grandmother, and my mother. The producer is Tiare-Summer Ka'ohunoelani Murray Kana'iaupuni. The point of this production is to put together a video with information about my family members and their lives so that I and other family members may refer to it later in the future. This program will not be to instruct but to inform. The specific audience are my family members. High school students could also watch this to get information about how Hawai'i was in the past. The props will be some of my grandparents' old coins, feather leis, poi pounders, badges from the army, and badges from being a firefighter. I will also view some pictures of the past that my family members have taken. "Grandpa" will be the song that will be heard throughout the video. This video isn't intended to be anything fancy, just simple and to the point. I will be the camera person throughout the entire taping time. The talents will be William Thomas Souza, who is my great-grandfather; Elmer Ka'ohunoelani Kana'iaupuni, who is my grandfather; and Muriel Ilima Kana'iaupuni. The site where I will be filming this video is at my great-grandfather's house in Wai'anae. It will take me about three weeks to complete this project due to my disadvantages of not living with my family because I am a boarder.

Courtesy of Tiare Kana'iaupuni

Fig. 1 Tiare's treatment for her family documentary video

Honi comes into the classroom to say that the Avid digital editor froze on her again. Sounds like the hard drive is too full. Something has to go. I ask her to tell Chris about the problem.

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On her way out, Carla says she doesn't think she will have more than two songs composed for the Senior Video by the end of the quarter. She is writing her songs on the computer using a MIDI and a keyboard. I say, "Hey! Two's wonderful. Maybe Jamie can use one of your songs for her memories section. Arista Records called yesterday and told her we would have to pay $10,000 for the rights to use one of their songs!" She's stunned and runs off smiling.

Katrina hands me her final draft of the script for her Beijing Opera documentary. I tell her that, before she records her narration, we should send it to someone to check for cultural accuracy.

Classes are over for the day, but the video club is coming in to talk about their fundraiser for their trip to Los Angeles. Some students need to finish up a section on the Ho'olaulea video the club is producing for the Association for Parents and Teachers. Some students will hang around after the meeting breaks up to figure out how to work the new computer graphics program that allows titles to "fly in" onto the screen. I'm ecstatic—another program a student can teach me! It will be quite a while before I get a free moment to learn it.

So it goes! Eighty students, from beginning to advanced, have come through the studio this day. I sit down on my chair and stare at the mess of papers, notebooks, and videotapes. I feel like a frazzled '90s version of *Our Miss Brooks!*[1] Here I am back in teaching after a nine-year hiatus and loving every minute of it. It's a thrilling time for students and teachers alike, not just at Kamehameha Schools, but everywhere. Education in the '90s is being revolutionized by technology, and students are excited by this new way of learning. Visual learners are finally finding a niche in the learning process.

With the rapid spread of new technology has come the popularization of visual literacy, bringing it out of specialized courses, such as television productions, into mainstream curriculum. Students are making videos, Quick-Time movies, multimedia presentations for classes in English, mathematics, and social studies as well as for documenting school events. The final products provide information that can be shared, not only with teachers, but also with peers who are generally more interested in viewing a video than in reading a written report.

The focus of the television productions program at Kamehameha Schools is to teach students how to express themselves through an electronic and primarily visual medium, video. During the semester course, beginning students experience the different stages of producing a video:

- *pre-production,* which includes researching and planning, writing a treatment or a narrative of production ideas, writing the script, drawing the storyboard (which serves as a kind of blueprint for putting together the video), casting the actors, reserving equipment, lining up crews and locations, scheduling interviews, securing music rights;
- *production,* which is the actual videotaping; and
- *post-production,* which includes logging the numbers of each shot, creating an edit decision list from the log sheet, and editing.

Patricia Gillespie

Beginning class doing production exercises in our TV studio

If students wish to continue in television productions, they can work on a specific project. The project could be the Senior Video, News 101, a public service announcement, a documentary, a drama or a comedy, an interactive multimedia presentation, a music video, or a project for another class.

In going through the production process, students learn to use camcorders as well as broadcast-quality cameras; a switcher for controlling shots from two cameras; an audio-board for regulating sound; an analog editor; and later a digital editor. Kamehameha Secondary School is one of the few high schools in the country to purchase the Avid Media Suite Pro, a state-of-the-art digital editor.[2] Digital editing takes the tedium out of editing and frees students to explore ways of expressing themselves visually and creatively. Thus, throughout their work in television production, students are not

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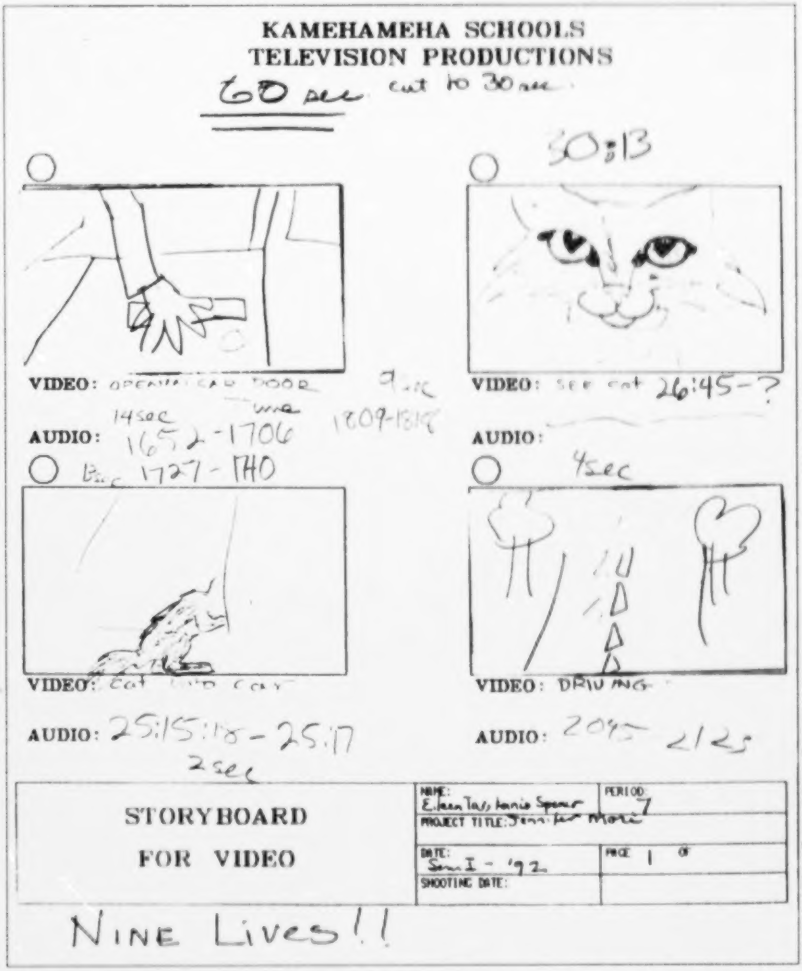

**KAMEHAMEHA SCHOOLS**
**TELEVISION PRODUCTIONS**

60 sec cut to 30 sec

○

**VIDEO:** OPENING CAR DOOR

**AUDIO:** 14sec 1652-1706 time 9 sec 1809-1818

○ Bac 1727-1740

**VIDEO:** Cat [illegible] car

**AUDIO:** 25:15:18-25:17 2sec

○ 30:13

**VIDEO:** SEE cat 26:45-?

**AUDIO:**

○ 4sec

**VIDEO:** DRIVING

**AUDIO:** 2045 2125

| | | |
|---|---|---|
| **STORYBOARD**<br>**FOR VIDEO** | NAME: Eileen Tan, Kanio Spencer | PERIOD: 7 |
| | PROJECT TITLE: [illegible] for More | |
| | DATE: Sem I - '92 | PAGE 1 OF |
| | SHOOTING DATE: | |

NINE Lives!!

Courtesy of Eileen Tan and Kanio Spencer

Fig. 2 Portion of a storyboard for a public service announcement on drinking and driving. The ending message was, "Cats have 9 lives, people don't. Please don't drink and drive."

only developing the writing, organizational, and analytical skills traditionally valued in education, they are also acquiring the technical skills that prepare them for a future in which technology will play an ever increasing role.

Because we are a school for native Hawaiians living in a multicultural society, our program emphasizes cultural documentation—from documenting personal family history to documenting the culture of a foreign

Patricia Gillespie

Honi Newhouse editing on the Avid Media Suite Pro

country. For students who choose to do a documentary, the experience provides powerful learning situations. Creating a documentary requires, among other things, researching, interviewing, organizing many hours of video footage, writing and re-writing, and using the technology. Recording a *kupuna* talking about the family genealogy empowers the student: she becomes the family historian, the documenter of traditions, the one who will preserve and perpetuate the culture of her family for future generations.

Since many of our students have cultural ties to countries in Asia and the Pacific, I think it's important for them to become familiar with cultures existing in those parts of the world. So I try to integrate the study of different cultures into the study of making documentaries.

My students and I have been fortunate to travel as a production crew to document activities—such as the Sixth Festival of Pacific Arts and the Marquesan Voyaging Project—that link Hawaiians with other South Pacific Islanders. Our association with the Hawai'i International Film Festival has provided yet another point of focus for international travel by allowing us to go on location to produce videos and materials for their film and cultural literacy curriculum. Short of experiencing it firsthand, what better way is there for young people to learn about a culture than to see it through the eyes of their peers.

Last summer seven students, three teachers, our technician, and I returned from shooting 60 hours of footage in China.[3] Upon our return, the students faced the final stages of the production process—they had to

Julee Abe

Katrina Souza and Vince Lucero on location in the Cook Islands.

integrate all the research and interview data, collected before and during the trip, with the many hours of footage and mold it into something other teenagers would want to see. It was like taking a huge jigsaw puzzle and putting all the pieces together to create something informative, absorbing, and artistic. Katrina and Honi, two of the students who went to China, described the challenge in this way:[4]

> How can we convey all of our feelings to the students watching our videotapes so that they can truly understand what we experienced? It's difficult to describe the feeling of heat and exhaustion that often was satisfied by only a few drips of very warm bottled water or very hot tea. . . . We would like to give our audience the awe-inspiring moment of actually standing in Tiananmen Square, knowing just five years ago hundreds of courageous Chinese visionaries were killed there, ending their quest for democracy. We simply cannot. We can only give the audience our visions of the simply unique people and country of China.

And that they did; but doing so was no simple task.

First, the students logged all the footage and then isolated the footage pertaining to each topic. After reading over the transcripts of their interviews and highlighting the important parts, they sat down at the computer and listed every shot and piece of information they thought important. The next step was to think of a lead-in that would grab a channel surfer's attention and to start writing the audio while keeping in mind the visuals that would "cover" it.[5]

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For the lead-in to her Beijing Opera video,[6] Katrina used the singing of a noted Chinese Opera singer, Mei Lan-Fang, as audio and as video, white letters on stark black background, the words:

> What does this sound like to you?
>
> Someone strangling a cat?
>
> Or maybe it is just a lot of terrible noise.
>
> Or maybe it is beautiful music to your ear.

Then, in silence, appear the words "Welcome to the world of *Xiqu*" in vibrant colors. Katrina reasoned, "I know when my friends hear this music, they're going to just go, 'What is this?'" In anticipating the reaction of her friends, she oriented the opening to her audience in a very clever way.

It is not easy to convince high school students that writing and rewriting is necessary to produce a quality product; that, in creating a video, it is better to show rather than to tell; and that, whatever they say, they must have an image that logically covers the words. Katrina describes how this process worked for her:

> Before you watch the footage, you kind of have an idea what direction you want to go, and then when you watch the footage, you see what you actually have to show the audience—like the best shots, shots that don't shake, shots where the color is okay, shots that don't have any video difficulties. And then from those good shots, you can firm up your ideas..., because now you know exactly what you have to work with.

Katrina also learned that the concept of time on video is very different from real time.

> In my first experience, I thought for each shot, you'd need like a minute worth of footage....My second time around, I learned that you only need like three seconds of footage; the attention span is shorter for a video. So I learned to get shorter clips and clips that directly relate to what is being said.

Finally comes editing—putting together images with a minimum of words to tell a story. With a digital editor, the final stages of creativity can easily flow. Students can arrange their images first in a bin that lets them experiment with placement. They can then drop those images into a timeline with narration and add special effects such as page turns, dissolves, titles that fly in or break up. Figure 3 is an excerpt from Katrina's final editing script for her Beijing Opera video.

Projects like the China documentaries have allowed our students to look closely at their own culture and the cultures that influenced them as Hawaiians. Over the years, our students have produced videos on

## WELCOME TO THE WORLD OF XIQU

*By Katrina Souza*

| **VIDEO** | **AUDIO** |
|---|---|
| The words: "What does this sound like to you?"<br>"Someone strangling a cat?"<br>"Or maybe it is just a lot of terrible noise"<br>"Or maybe it is beautiful music to your ear."—all this in black & white | I want to have slow Beijing Opera music—Mei Lan-Fang singing would be good |
| *"Welcome to the world of Xiqu"* in vibrant colors | On the downbeat of the slow music cut to this graphic in silence |
| **C. G. Beijing Opera School**<br>**Tape #10**<br>18.15.22.00-18.15.24.00 boy w/makeup<br>18.06.21.00-18.06.23.00 shaving head<br>18.07.10.25-18.07.12.00 2 boys putting on makeup<br>**Tape #11**<br>20.21.49.00-20.21.51.00 boys at Opera school flipping warm-ups<br>20.32.12.00-20.32.14.00 2 boy generals singing<br>**Tape #8**<br>14.15.34.00-14.15.36.00 woman general batting away poles<br>**Tape #7**<br>12.21.54.00-12.21.56.00 boy painting his own face | Start in with fast Opera music |
| **UH Tape**<br>01.07.40.00 girl singing<br>**On monitor then cut to footage**<br>23.59.25.00 cartwheels across stage | **Voice over with natural show sounds of footage**<br>My first experience with Xiqu, or, as it is more commonly known here in the Western world, Chinese Opera, was at the University of Hawai'i. The students at UH were performing a xiqu play called "A Spark Amidst the Reeds" directed by Elizabeth Wichman, who became famous for being the first foreigner to perform one kind of Chinese opera, which is Beijing Opera, in The People's Republic of China. |

Fig. 3 Katrina's final editing script for her Beijing Opera video.

Indonesia, China, and the South Pacific; these videos are being used by schools throughout Hawai'i to support their curriculum in a variety of courses.

The final products can have a powerful influence on other teenagers. Mary Helen Kaser, a Roosevelt teacher who was one of the teachers on the China project, recently showed Honi Newhouse's video, "Balancing the Self: The Art of Chinese Medicine," to her English class of aspiring filmmakers. They were so inspired by what they saw that they came up with ideas for videos they could make here in Hawai'i and wanted to invite Honi to talk to them about the art of making videos!

* * * * * * * * *

I shut off the equipment, turn off the lights. I'm about to close the door when the phone rings. Should I answer it? It's already so late, I'll never get home. I drop my books, turn the light back on, and rush to the phone before it goes to my answering machine. It's Leah at USC.

> Hey, "G"! Guess what? I just got my term paper back on Balinese Hinduism. I got an A! It was the most exciting term paper I ever wrote. When I was interviewing experts, I began to really understand those ceremonies and traditions I videotaped two summers ago in Bali. I, too, felt like an expert!

I laugh, talk a while, hang up. As I grab my books, turn off the light, and close the door, I think, "Ah! A teacher's reward!"

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**Footnotes**

[1] A popular television sitcom in the late '50s, *Our Miss Brooks* featured a high school teacher and her "adventures" in school.

[2] In the professional production world, computer and video technologies have merged, making the digital logic of the computer the norm.

[3] The Hawai'i/China Educational Connection was made up of five Hawai'i Video Curriculum Association teachers; Irene Yamashita, formerly teacher at Kapunahala Elementary School and now Midas Project resource teacher; Mary Helen Kaser, publications teacher at Roosevelt High School; Lily Lu, Chinese teacher at Kamehameha Schools; Chris Brainerd, technician at Kamehameha Schools; and Patricia Gillespie, television production teacher at Kamehameha Schools. Students who participated were Edward Lu of Roosevelt High School; Carlin Yamashita of Kapunahala Elementary School; and Eric Daley, Hoku Haiku, Katrina Souza, Nathan Yap, and Honi Newhouse, all of Kamehameha Schools.

[4] Souza, K. & Newhouse, H. (1994). On location in China. 1994 *Hawai'i International Film Festival Guide.*

[5] In technical terms, this is called "B" roll; it is something a young filmmaker always has to keep in mind when shooting an interview.

[6] The Beijing Opera video is one of four videos produced from the China footage thus far. The other three videos are about life in China, Chinese medicine, and Chinese martial arts.

# Computer Learning for Young Children

**Anita Y. W. Choy**

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***Anita Y. W. Choy** is Curriculum Developer for family involvement and culture in the PreKindergarten Educational Program at Kamehameha Schools Bishop Estate. She has been in early childhood education since 1978 and has worked as teacher, educational specialist, trainer, planner, and childcare center director.*

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Isaac and Aukai are at the computer center. Seated in front of the keyboard, Isaac has decided to work on the program *Playroom*. He places disk A into drive 1, turns on the computer, monitor, and printer. He waits patiently for the program to come on the screen. When the screen finally lights up, Aukai, sitting beside Isaac, starts to tell him what to do on the computer.

**Aukai:** Try it here; put it on the dinosaur. (He points to the sleeping dinosaur.)

(Without saying a word, Isaac presses the arrow keys and moves the cursor, in the form of a big arrow, to the dinosaur. When the arrow lands on the dinosaur's body, Isaac presses the Return key. The dinosaur opens his eyes and taps his tail.)

**Aukai:** You did it! (Isaac smiles and presses the arrow keys to guide the big arrow to other icons on the main menu. When the big arrow lands on the drawer icon, he presses Return. The drawer opens and a red balloon flies out.)

**Isaac:** Look! I'm going to pop the balloon.

**Aukai:** How do you do that? (Eyes still focused on the screen, Isaac moves the arrow toward the balloon. When the arrow reaches the balloon, he presses Return.)

**Isaac:** I popped the balloon.

The Kamehameha Journal of Education (Summer 1995), Vol. 6, 49-59

**Isaac:** I like to play another game. (He moves the big arrow to the ABC book and presses Return. When the screen flashes a message to put disk C into disk drive 1, he takes disk C out from its jacket, inserts it into disk drive 1, and presses Return. Aukai is watching and chatting with him.)

**Isaac:** I'm putting the king away....No, it'll be together. (He places the second king on top of the first one, making it look as if there's only one king.)

**Isaac:** You know what I'm going to do, I'm going to throw the boy away.

**Aukai:** No, give it to the horse.

**Isaac:** (Thinks for a little while) Okay.

**Aukai:** I want to play the computer after Isaac. (Two children are now behind Isaac and Aukai; they also want to play the computer game. When Isaac stands up, Aukai slips right into the seat and begins pressing the keys. The other two children leave the computer center.)

**Aukai:** I like to play another game. (Aukai is now able to take out disk C by himself and replace it with disk A in order to return to the main menu.)
I'm going to make his tail move. (He points to the dinosaur.)

**Aukai:** I did it!

**Aukai:** I'm going to play another game. (The screen flashes a message for him to put disk D into disk drive 1. Without checking, Aukai takes disk A out, flips the disk over, begins to insert it into the disk drive.)

**Isaac:** No, the other one. This is B. (Isaac gets up, takes disk D from the diskette holder, and gives it to Aukai. Aukai takes the disk and examines both sides.)

**Aukai:** This way. (Isaac nods. Aukai inserts the disk as Isaac guides him.)

**Aukai:** How do I wake him (pepper mouse) up to play game like what you did?

**Isaac:** Press here (pointing to the Return key) and wake him up. (Aukai follows Isaac's instruction and plays the activity with pepper mouse.)

The Bell rings. It is clean-up time.

**Isaac:** Take the disk out and turn off the computer. (Isaac helps Aukai turn off the CPU while Aukai turns off the monitor and printer. As the two of them leave the center, Aukai checks the CPU and makes sure Isaac did indeed turn it off.)

Ramona Newton Hao

Isaac and Aukai are *four years old* and students in one of Kamehameha Schools' preschools.

Preschoolers may not use computers with the same sophistication as school-aged children, but from watching interactions like the one above, I'm realizing that computers can become a meaningful part in the life of preschoolers. Computer activities combine education and entertainment and thus make learning fun and enjoyable... and easier. Computers can help children practice readiness skills; they can help children create, explore, solve problems, and interact with others.

When computers are an everyday part of their preschool classroom, children see that they can be fun: they learn how to turn the machine on; they learn to use the function keys with the help of adults or by watching experienced peers; they learn to try things out on the computer and make it do things. Developing a liking for working on computers—and with hi-tech in general—may be the best reason for having computers in preschool classrooms.

## Learning with Computers

### Social Skills and Learning by Watching

The great fear we have is that computers will make children unsociable and interfere with their development of social graces. But seeing the interaction between Aukai and Isaac allays these fears. Aukai and Isaac work as a team, with Aukai offering suggestions and Isaac operating the computer. They talk with each other about what they want the computer to do and then watch those things unfold on the screen. These two four-year-olds have mastered important social skills. Throughout the 15 minutes, they respect each other's desires, they take turns, they make decisions together, they ask help of each other—they cooperate.

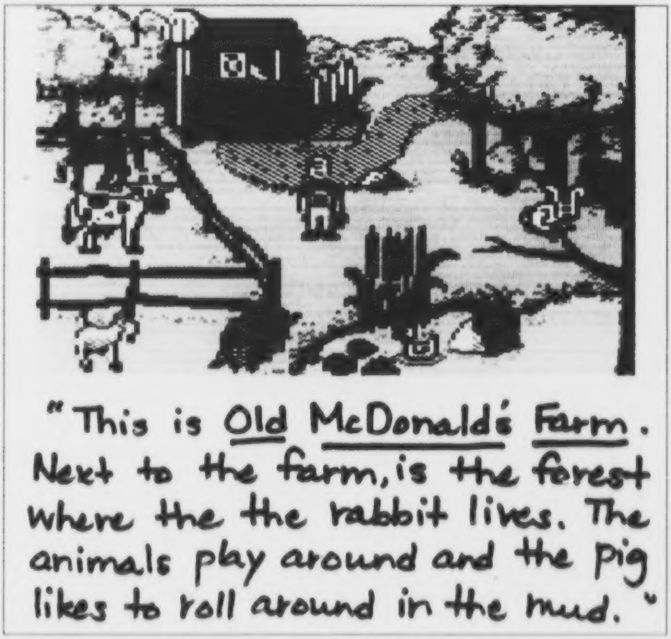
The vignette also shows *learning by observation.* Aukai learns how to operate the computer and how to use the software by watching his friend. Vygotsky, the Russian psychologist who wrote over 60 years ago, was right—children learn by participating with others, adults or more knowledgeable peers, in activities they cannot yet do by themselves.

Since computers were introduced in selected Kamehameha preschool classrooms, I have seen children gather around the computer learning center and use various software programs. They explore the programs enthusiastically with their peers or adult volunteers.

## Language and Literacy Skills

Much talking goes on while the children work at the computer. The images on the screen seem to stimulate sharing of impressions and ideas. Thus, the main menu of *Playroom* prompted Aukai and Isaac to discuss what the various icons do; seeing the balloon in the drawer, Isaac announced his wish to pop the balloon.

Our preschoolers use the computer to design pictures and create stories, which they "dictate" to an adult who writes underneath the picture. This is the story and picture Shayne created. Many children want to "read" their



"This is Old McDonald's Farm. Next to the farm, is the forest where the the rabbit lives. The animals play around and the pig likes to roll around in the mud."

story and share it with their class. At times, the preschool teachers are surprised at the quality of thinking, imagination, and language that is reflected in the stories.

Even with the outdated Apple IIe computers in our classrooms, the children can practice literacy skills by writing messages and reading text on the screen with the help of adults. How much more we could do with software that will allow a computer to take dictation and talk to children!

## Cognitive Development

Young children learn through exploring, manipulating, and experiencing their environment. The computer is now becoming part of this environment. How such early exploration of technology affects cognition, and whether it produces fundamental changes, still needs to be researched. What we do know is that quality software programs can promote problem solving and can help teach such concepts as numeracy, seriation, shapes, and alphabet recognition. Let's listen in on Jordan, Micah, and a parent.

**Parent:** Let's play another game. It's called *All about Shape.* Press One and A, Micah....Tell me the name of this shape.

**Micah:** It's a circle.

**Parent:** There are four shapes on the right. When the arrow moves onto the shape that matches the circle, press the Open Apple key.

**Micah:** (Presses the Open Apple key when the arrow lands on the circle.)

**Parent:** Great! You matched the shape. What color is the circle?

**Micah:** It's blue.

**Parent:** Jordan, now it's your turn.

## Eye-Hand Coordination

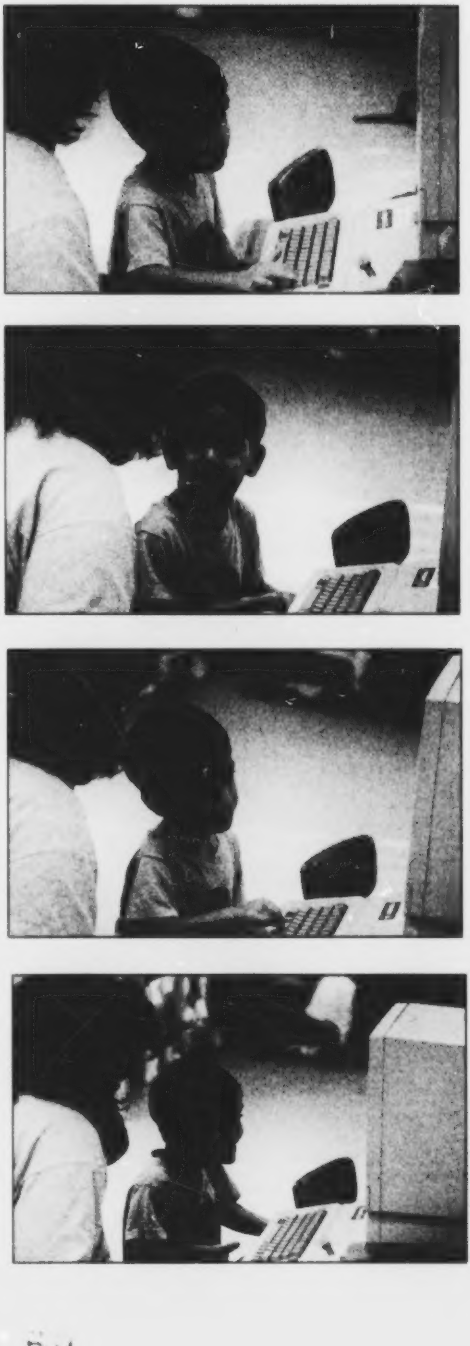
To change things on the screen and to make the computer do things, the children need to move the joystick or the arrow keys—movements that require fine eye-hand motor coordination. For instance, by moving the arrow keys, Isaac was able to "paste" the second king on top of the original and make it into one; Aukai was able to make the dinosaur wag its tail by moving the cursor onto the dinosaur's body. Jordan and Micah had to press the Open Apple key just when the arrow pointed to the matching shape. It took them many tries before they were able to press the key at precisely the right moment. The desire to get a particular effect motivates children to develop precise movements.

## Setting up a Computer Center in Preschool

When setting up a computer learning environment in a preschool, numerous questions come to mind; numerous decisions must be made. I'll share here some of my experiences in helping teachers set up a computer environment in their classrooms.

Although children may be drawn to a computer on their own, adult guidance in using the computer and software will enhance children's learning. The adults can create an environment that supports children's exploration and natural curiosity. An adult's attitude toward computer learning influences how a child will approach the computer; an adult who shows enthusiasm reinforces a child's excitement and delight in working with the computer. When exploring software with young children, the adult should guide them gently and help them build upon their previous experiences.

The recruitment of adult volunteers for this role has been the most challenging part of the project for me. Many family members of our preschoolers are willing to help but have limited

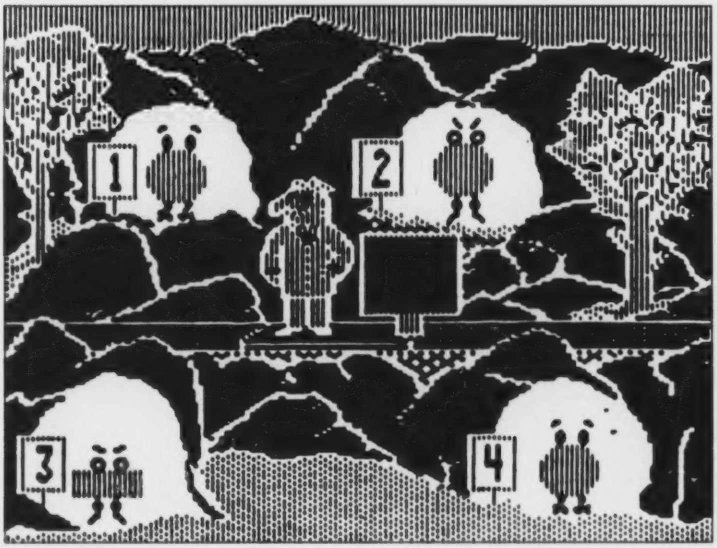

Ramona Newton Hao

knowledge of computers. I have, therefore, created a training guide for teaching staff and potential volunteers. The guide directs volunteers to facilitate rather than instruct when helping a child become familiar with the computer. The goal, as the guide explains, is to enable the children, by the end of the year, to use familiar software on the computer without adult help.

I do a half-day training session with the volunteers to familiarize them with the computer and with the guide. In this training session, the volunteers learn how to operate a computer, come to understand how children can learn from computer programs, and learn how to keep records of the children's computer achievements. In the last part of the workshop, they practice using the guide with the available computer programs. Most adult volunteers are able to operate the computer and work with the software after just one training session.

In the following interaction, one of our parent volunteers, Mr. Bento, displays the kind of guidance we think is so important for our children's successful introduction to the computer. Mr. Bento is working with two preschoolers (James and Kalai) on a program on shapes and colors.[1]

Their monitor screen shows four caves, numbered 1 through 4. In each cave is a figure whose body is in the form of a colored shape. The object of the activity is to select the cave that contains the form that is different from



the other three in shape, color, or both shape and color. The student has to press the keyboard key that corresponds to the number on this cave. If the student chooses the correct cave, the figure in it disappears; if the student chooses incorrectly, nothing happens.

Mr. Bento first checks to make sure the students can locate the keyboard keys for numbers 1 through 4.

**Mr. Bento:** Now, James, what shape is this? What shapes are these things in the caves? What shape is that (pointing to one of the caves)?

**James:** Square.

**Mr. Bento:** Square, okay. And which one is different? (When James doesn't respond, Mr. Bento continues.) What color is this square (pointing to cave #1)?

**James:** Blue.

**Mr. Bento:** What color is this square (pointing to cave #2)?

**James:** Blue.

**Mr. Bento:** What color is this square (pointing to cave #3)?

**James:** Blue.

**Mr. Bento:** And what color is this square (pointing to cave #4)?

**James:** Green.

**Mr. Bento:** So which is the different color? What number? Point to the cave that has the different color.

**James:** (Points to a cave with a blue square.) Blue.

**Mr. Bento:** Blue. Okay, find the one that is not blue. Find the square that's not blue.

**James:** (After a few tries, James finally points to the cave with the green square.)

**Mr. Bento:** Right there; what color's that one?

**James:** Green.

**Mr. Bento:** Green; okay, push that number. What number is that?

**James:** One.

**Parent:** Okay, good.

After guiding each student through several rounds of this activity, Mr. Bento notices the children are slow to respond to the question, Which shape/color is different? When he substitutes *not the same* for the word *different,* "it sort of clicks" for them. When he senses they are catching on to the concept, he returns to using the word *different.*

Mr. Bento helping two preschoolers learn a new program.

Ramona Newton Hao

Mr. Bento gives less and less support as the students become familiar with the routine.

**Mr. Bento:** Okay, James, this is a hard one. Can you find the one that's not the same, the shape that's not the same, the shape that's different. (James points.) Good job! Push that number. What shape is that?

**James:** (Says something that sounds like *rectangle.*)

**Mr. Bento:** Rectangle.

**James:** Rectangle.

A very practical concern for teachers is the placement of the computer. To most of the teachers, safety is a top priority: the computer must be placed in an area where electrical cords can be tucked safely behind the machine. But there are other considerations, too. Some teachers prefer the computer to be set up near their library corner or their writing or art center to allow extension of activities from those centers to the computer—or vice versa. Other teachers worry about making sure the computer is out of the way of direct traffic, noisy areas, or direct sunlight.

Another question teachers must deal with is how to integrate the computer into the preschool curriculum. Here again, I have found great variation in preferences among teachers. Some teachers want to have software related to the classroom's weekly or monthly theme. They select the software themselves and assist parent volunteers in getting familiar with the programs. These teachers also schedule the times when children are to work on the computers. Usually these teachers will display for use only those diskettes needed for the week. Other teachers do not care so much about which programs the children learn and encourage parent volunteers to choose the software from all programs available.

I have found it is important to keep a record of each child's progress. This allows the different volunteers to find out what the child knows and how to guide the child's further explorations. Thus, in our classrooms, each child has a file folder that contains the pictures or graphics or stories he has created. Moreover, for each software program, I have created a checklist on which the volunteers can indicate which parts of the program the child can do. These checklists help both teachers and adult volunteers to identify what and how our young children are learning through working on the computer.

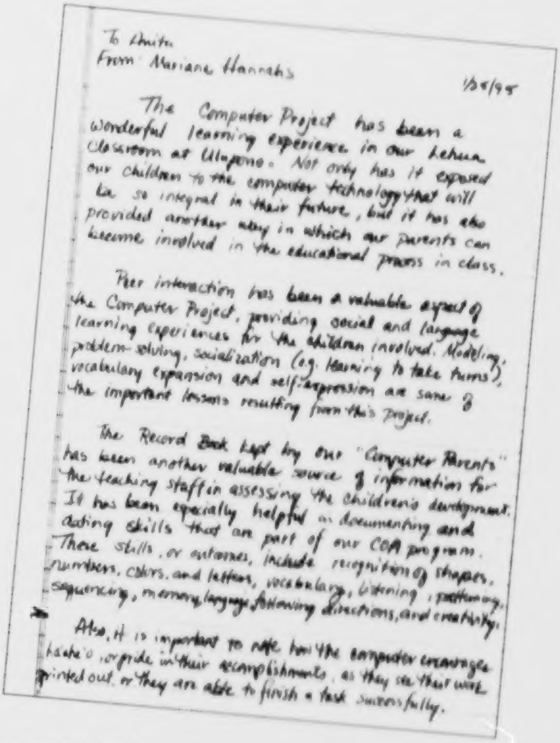
What kind of machine, what kind of software should I buy? is a common question from my parent volunteers. "Young children need the most powerful machine. The quality of graphics, sound, animation, and visuals that young children need in order to learn demand the most powerful machines."[2] After three years of working on this preschool computer project, I also believe that it is important to have powerful equipment in order to be able to run quality, age-appropriate software to support young children's learning. Challenging and high-quality software programs, well-suited for children's cognitive development, are now available. However, these programs cannot be run on yesterday's equipment.

IBM, IBM-compatible, and Macintosh machines offer a variety of software for educational use. Which machine or system one chooses is not so much a function of which is better (it is difficult to rate one better than another) but a function of individual preference and comfort with a particular setup. I recommend that a prospective computer shopper ask the opinion of computer experts who are familiar with the kind of use to which the computer will be put, read fact sheets about the systems, and test display models in stores.

There are also computer magazines that provide detailed information about choosing machines and software for young children: *Children's Software Review, Kid's Software Club, MacWorld,* and *PC Magazine*, to mention a few. These magazines discuss educational value, user friendliness, and quality of software and hardware. But they are, of course, advertisements. Before any purchase, adults should check with computer experts in stores as well as try out the machines or preview the software. Parents can also check the opinions of their child's teacher or the school computer specialist. It is important that the software be appropriate for the young child. The most expensive software may not be ideal for the particular age of a child.

As with everything else we do to help youngsters be versed in the complex skills required in our society, familiarizing preschoolers with the computer and finding ways they can learn from computer programs take effort and thought. For those teachers who have invested this effort, it seems to have been rewarding.

I conclude with a memo I received from one of our preschool teachers.



To Anita
From: Mariane Hannahs
1/25/95

The Computer Project has been a wonderful learning experience in our Lehua Classroom at Ulupono. Not only has it exposed our children to the computer technology that will be so integral in their future, but it has also provided another way in which our parents can become involved in the educational process in class.

Peer interaction has been a valuable aspect of the Computer Project, providing social and language learning experiences for the children involved. Modeling, problem-solving, socialization (e.g. learning to take turns), vocabulary expansion and self-expression are some of the important lessons resulting from this project.

The Record Book kept by our "Computer Parents" has been another valuable source of information for the teaching staff in assessing the children's development. It has been especially helpful in documenting and dating skills that are part of our COR program. These skills, or outcomes, include recognition of shapes, numbers, colors, and letters, vocabulary, listening, patterning, sequencing, memory, language, following directions, and creativity.

Also, it is important to note how the computer encourages keiki's, or pride in their accomplishments, as they see their work printed out, or they are able to finish a task successfully.

*Note:* I'd like to express my appreciation to the staff of the Kamehameha center-based preschools at Kona, Ulupono, and Wai'anae for all their help and support.

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**Footnotes**

[1] Muppetville = Gonzo's Zoo [Computer software].

[2] Bredekamp, S. & Rosegrant, T. (1994). Learning and teaching with technology in young children. In J. L. Wright & D. D. Shade (Eds.), *Active learners in a technological age.* Washington, DC: National Association on the Education of Young Children.

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# Free in First Grade: Technology in One Classroom

## Cathy Weaver

***Cathy Weaver** has been with Kamehameha Schools for 15 years, first as a language arts consultant and currently as a first-grade teacher. The best times in her life have been when she was engaged in intense and active learning. Among those times were becoming a parent, para-sailing, learning the Thai language, and being immersed in the technology described in this article.*

A year ago, just before Christmas vacation, workers with dollies wheeled an assortment of large boxes into my classroom. The boxes kept coming, one after another, and the first graders watched with wonder as they were unloaded in the corner I had cleared out for them. The students viewed the boxes much as they did the Christmas presents under their trees at home. "Let's open them," they said. "When can we use them?"

When we returned to the classroom in January, we found the boxes unpacked and assembled into a "wall of technology" brand new to all of us and, for the moment, still an exciting mystery. With eagerness, the students waited to try out their new toys.

I was eager, too. I had volunteered to be one of the teachers at our school to try out the Educational Management Group's (EMG's)[1] ES 2000 computer workstation. I think the idea was, if it works for first graders, it will work for any grade. Those boxes had held a 24,000K Macintosh computer, 24-inch monitor, color flat-bed scanner, color printer, CD-ROM Quadraspin, camcorder, fax machine, speakerphone, and satellite hookup. Up until then, I had made friends with technology through using computers for my own and students' writing. But I saw that this had been like driving leisurely down a small town street; now the street signs were changing, and I was headed for the on-ramp of a FREEWAY of technology! Suddenly Al Gore's metaphor came alive for me, and I had fears about keeping up with the speed of the traffic!

The Kamehameha Journal of Education (Summer 1995), Vol. 6, 61-70

It's interesting to look back on my year-long journey down that freeway and to peer ahead into all those unknown miles still stretching in front of me. The journey for teachers is not only about learning the technology but also about creating a vision of *how* to incorporate the technology into the classroom. Most educators, I'm sure, feel strongly that at the heart of learning is the teacher's interaction with the students. When technology is introduced, a gut reaction is triggered, a fear that the dynamic teacher-student interaction will be replaced with a computer screen. We teachers see the specter of a collection of software tutorials substituted for rich literature, of math manipulatives and problem solving shelved in favor of clicking on a correct answer on a computer screen. Many of us, furthermore, view technology as one more piece in an already full curriculum, something that needs to be added to get that weekly *dose* of technology. Thus, a major issue for teachers is the question, Will my curriculum be made to serve technology, or will technology be used to serve my curriculum?

I wasn't about to give up a bit of my passion for literature and for writing in my classroom. I had to look for ways of using that new equipment in my room to enhance what I already love to teach. Since I'm not a lover of technology for its own sake, teaching my students to use the equipment was not going to be an overriding goal. However, I would be happy if they learned to use those new tools while they worked on projects that grew out of our classroom pursuits.

Relying on tutoring from the EMG consultants and on teacher training via satellite broadcasts, I began my learning with the flat-bed scanner. Because it works much like a photocopier, it was easy to learn. I had ideas of using it to enhance various types of "publishing" the students and I did. At the time, we were studying the author Jan Brett and were planning to display the students' book reviews in the school resource center. The scanner gave us a way to produce color copies of the covers of the books the students were reviewing.

After demonstrating to the class what the scanner could do, I called Anthony to sit beside me at the workstation. I talked him through the steps involved in scanning his book cover. He was fearless as he placed the book on the scanner and clicked the mouse to begin the process. What surprise on his face when the book cover leapt onto the computer monitor! What intensity in his expression as he bent over the printer to watch as the colored page fed into the tray. I couldn't have crafted a better advertisement to get everyone excited and involved. So Anthony became the teacher for the next student, talking her through in the same way I had done for him. By the time all the book covers were scanned, each student had taken a turn as learner and as teacher.

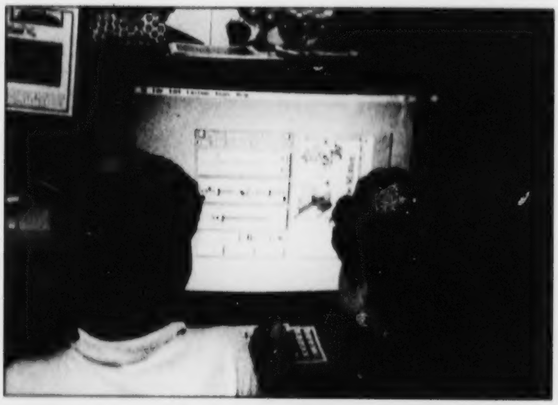
Meanwhile, the students were busy writing their reviews. Their visions of the project began to be stretched by our new equipment. Couldn't we add photos of them *holding* the scanned book covers to the book review display? It was a great idea. This drove me on to learn how to use the camcorder to "freeze" and print photos right in the classroom.

The students really got into it and tried out various body positions to appear as if they were balancing giant books on the head, on the back, on an outstretched foot, or on the tip of a finger like a spinning basketball. The book reviews turned into book posters, and writing for the posters became very important to the students. The added glitz, provided by the technology, motivated quality writing and resulted in a product they were all proud of. Two weeks before, not one of them had known what a scanner was. Now they all knew how to use one!

We wrote book reviews about our favorite Jan Brett books.

We put the Jan Brett books into the scanner to take color pictures of the covers.

Ramona Newton Hite



Each person had to teach the next person to use the scanner.

We pointed the video camera at someone and used the Frame Grabber to get the photos. We made our bodies look like they were holding up giant books.

Ramona Newton Hao

We put the photos into *DeskPaint*.

... and used the mouse to trim around the bodies. This was hard to do!

Ramona Newton Hall

We watched the color printer as the paper came out.

Courtesy of Cathy Weaver

We put all the parts together ... our book reviews and our bodies holding up the book covers. We put these up in the school resource center.

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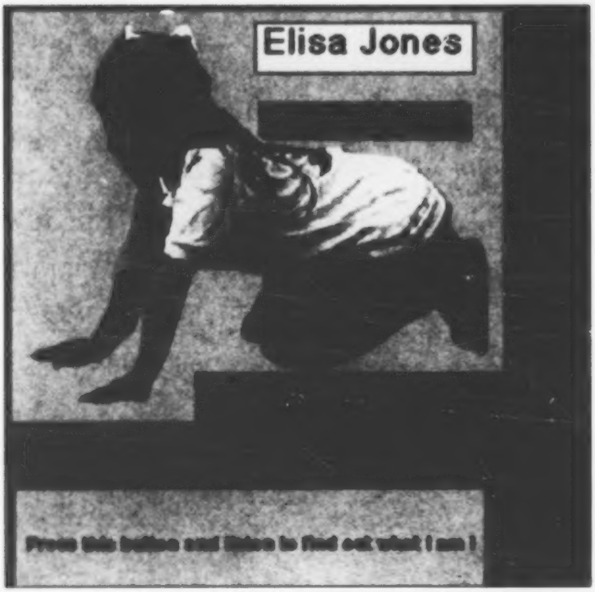
We were one month into our new technology and found ourselves hurtling down the technology freeway. No one wanted to get off! What project next? But I kept my goals of teaching reading and writing in mind. I like to introduce research skills by doing a study of animals. In past years, we would take a trip to the zoo, and each child would choose an animal to learn about, read several books, and record facts in various categories: body, habitat, diet, and so forth. I wondered how technology could expand this project?

I decided we would explore our collection of CD-ROMs. The Quadraspin holds up to six different CDs containing 650Mb each. This is a tremendous wealth of information, including text, sound, maps, and Quick-Time video. By selecting buttons on the monitor, a student can access facts from those multimedia CDs. He can see his chosen animal in its native habitat, hear its sounds, study its anatomy, see it hunting or playing, and have a close-up look at the animal's features such as its feet or its skin texture. The desired information can be printed out.

These CD-ROM capabilities provided the students with other sources for their research besides the animal books brought in for the project. The workstation became a center in the classroom where two or three students could work together at a time. Collaboration and enthusiasm were encouraged by the excitement of multimedia research; I have never seen so much sharing of information. Students wanted their friends to see the incredible things their animals could do. I'll always remember Keoni's look of amazement and his incredulous "Cool!" as he discovered this research by CD.

The animal research project ended with writing animal riddles and publishing them as an electronic book. Each student designed a "page"—one computer screen—for the riddle he wrote. Students could decide which animal sounds and Quick-Time movie clips they wanted to include from a CD and "paste" on their screen page. These clips showed up as colorful buttons which could be activated by clicking the mouse on them. Finally, each screen had a camcorder "frame-grab" photo of the student posing as the animal. This project seemed to accommodate different learning styles among my students. Ka'imi, who loves movement and drama, studied his monkey until he could mimic its body posture curled around a branch and holding a twig. The photo of him in this amazing position became a clue for his riddle. Rhean, an excellent reader, preferred to do most of her research using books and created a long, detailed riddle from her readings.

"Let the kids first play with and explore manipulatives freely. Then they'll be ready to focus on specific learning tasks." I have found this advice to be also useful with adults and hi-tech equipment. The fax machine is a



perfect example. I spent two weeks "playing" with a colleague, the teacher of our fifth-grade buddy class. We faxed silly rhymes and messages back and forth, calling on the phone to ask, "Did you receive it?" This was our free exploration of this new machine before we discovered a practical use for it. Then one day he needed to reschedule his class's visit to us. He found it very efficient to simply fax his entire schedule to me—one of my first graders discovered it in the fax tray. We checked our schedule and faxed back a response. How practical!

To neophytes, technology has an aura of mystery about it. I have only the crudest understanding of how a fax machine works. The class also seemed to accept it as magic. Two students had fax machines at home. They wanted to design pages on their home computers and fax them to us in class. They rushed in with excitement the next morning to see if their transmissions were waiting in our fax tray. Suddenly the wonder of it all dawned on Kanoe. "How did the machine get it from his house all the way to school?" she asked. How, indeed! The kids and I learn and are amazed together. We are now looking forward to using our fax machine to communicate with a pen-pal class in Maryland.

Telecommunication, probably the most dramatic and powerful capability of my classroom technology, is something we have only dabbled in so far. My students took an electronic field trip to snow, something most of them have never experienced. They watched a live satellite broadcast of a class in Flagstaff, Arizona. Making snow angels and sledding down a snowy hill, that class explained the fine points of shaping snowballs and dressing for the cold. For my students, it was the next best thing to being there, and their faces were rapt with attention! Using our speakerphone, they were able to speak, child to child, and ask the snow experts things that first graders wonder about: "Are there bugs in the snow?" "Do your pets go outside in the snow?"

Another powerful way to communicate with others around the world is with e-mail. We want to explore this much more. The possibilities are limitless. As these first graders grow up with telecommunications, they'll be able to have electronic pen pals, participate in live lessons and presentations given anywhere in the world, learn of latest findings, talk to experts and ask them questions.

Our culminating project last year will always be special to me. Let me tell you how it evolved. It began with our reading the memoirs of several authors. Cynthia Rylant is a children's writer who really came alive for the students. We saw childhood photos of her and read her memories in her autobiography.[3] Then we revisited some of those very same memories beautifully woven into her other books.

The first graders got the idea that experiences in people's lives are precious and worth writing down, and they decided to write their own first-grade memoirs. They adopted Rylant's format, which starts each new snippet of memory with the phrase "When I was young in the mountains..." This is also the title of her autobiography. The students named *their* memoir *When I Was Free In First Grade* and set out to record the happenings from this first-grade year of their lives—very appropriately egocentric for this age when everything important is happening right now, in the present.

In the middle of all this, I found another memoir written by a woman who was a child in Hawai'i when Pearl Harbor was bombed: *Pearl Harbor Child.*[4] There were photos of her as a six-year-old wearing her gas mask and stories of hiding out with her family in the cane fields the entire day of the attack and of a frantic search for her pet dog after the bombing. The students were mesmerized. They could relate to this child. Suddenly, there was an explosion of interest about World War II. Their curiosity was directed beyond themselves. We began talking about the war, and the conversations continued at home. Parents, picking their children up at the end of the school day, asked me, "How did this get started?" Students were calling uncles and grandparents to find out what they remembered from that time period. Their world was suddenly bigger and included now a past tense.

I was amazed by their interest and by the warmth of parents who said they loved the intergenerational dialogue this had started. The students invited parents and grandparents to record their memories. Soon, typed or handwritten memories were coming in to class. What incredible memories the grandparents shared … a grandma, growing up in the Philippines, wrapping her school lunch in banana leaves; ice cream for five cents; a grandfather who remembered the unique sound of *his* father's horse as he drove the wagon home from work each day. So each student's first-grade memoirs expanded to include memories of parents and grandparents to create a personal three-generation memoir book.

Although this was a reading and writing project at heart, our classroom technology allowed us to broaden its scope. We captured marvelous old photos with our scanner. We accessed information from the past via our CDs. We watched a video clip of Hitler's goose-stepping troops and heard Winston Churchill's voice, all from our classroom. This was not typical first-grade material, but it grew naturally out of our project, and the technology brought it alive!

The collaborative class-memoir project eventually became an electronic memoir, with the photos and voices of the children mingled with their writing. It is accessible, via the Edunet Updater, to classes across the country. It will also be stored in our school computer lab, so the children can come back as high schoolers, or as grandparents, and experience who they were when they were "free in first grade."

My worries about technology driving my curriculum have proved unfounded. I can hold on to what I value most—a classroom immersed and in love with reading and writing, and I can use the technology to add even more fire to that passion. We still pursue projects that grow out of literature and student questioning. I can still use cooperative learning, enhanced by the excitement of discovery as students work together, discuss, and problem solve in pairs at the computer. Technology hasn't replaced dynamic student-teacher interaction, rich literature, or math manipulatives. My priorities have not shifted, rather the shape, dimension, and variety of studies in my classroom have been broadened and enhanced.

The traffic speed on this technology freeway, another of my original worries, *is* dizzying at times. A good support system, such as I have enjoyed, is essential. I have needed someone available not only for initial training but also to answer my questions as they come up. Having a group of colleagues learning along with me has been comforting and stimulating. Our regular technology meetings are some of the few after-school meetings I actually look forward to!

There's no denying that it takes extra time to learn something new. Especially in the field of technology, the learning never stops. As I write this, after one year of getting comfortable with the equipment in my classroom, I have just had something new added to my wall of technology: a two-way V-Tel Video Camera. So I will be a beginner again. I know this camera will allow us to send a sound and video signal through a compressed fast-data line, making possible face-to-face visits with a class clear across the country. Beyond that, it's a brand new mystery to be unlocked. That's exciting! Being with my students as a learner myself is a role I enjoy.

As my first full year on the technology freeway draws to a close, I am struck by the aptness of that phrase "free in first grade." It really captures the energy and enthusiasm, the "sky's the limit" mind-set that has infused our classroom. We all have felt the thrill of expanding our borders. As I have learned to set aside the fear of the technology controlling *me,* I have found it to be a set of tools I can use to broaden and enhance our classroom pursuits. I'm happy to be on this freeway, and I look forward to a lot more traveling!

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**Footnotes**

[1] Educational Management Group is a Phoenix-based high technology educational service. Kamehameha Schools Bishop Estate has contracted the services of this company.

[2] Thanks to Kanoa Gabriel and Anthony Pe'a for helping us photograph these steps.

[3] Rylant, C. (1982). *When I was young in the mountains.* New York, NY: E. P. Dutton.

[4] Makanaōnalani-Nicholson, D. (1993). *Pearl Harbor child.* Honolulu, HI: Arizona Memorial Museum Association.

# New Technologies, New Curricula

**Gisela E. Speidel**

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*This article describes the AutoCAD Laboratory at Kamehameha Secondary School and an interview with* ***Robert Horwath,*** *the AutoCAD instructor and Technology Department Head. Throughout his 25-year teaching career, he has dedicated his energies to teaching theory and concepts together with practical skills and has encouraged the recognition of students who are gifted with both academic abilities and manual dexterity.*

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"Go to the top line and double this one, draw from viewport to viewport."

"I should zoom?"

"Yeah!"

"Is it 1.25 or negative when you zoom?"

"I just labeled it."

"Like that?"

"Go Solcyl. Then your center point is gonna be in the middle."

What kind of jargon is this? It's the language of AutoCAD.[1] I'm in the AutoCAD laboratory of Kamehameha Secondary School. It's a light, airy room. Twenty large drafting tables stand in rows. A few students are helping each other; others are busy typing on keyboards and gazing up at suspended color monitors to see what their keyboard strokes and mouse clicks have produced.

Standing behind a student, I watch him hack away at the keyboard. I am amazed. Lines appear on the screen, shapes; they move around. This young man seems to know exactly what he is doing—and the other students do, too. Are these high school students? Where's the instructor? Finally I spot him, Bob Horwath, the AutoCAD instructor. He's working with a student in the far corner.

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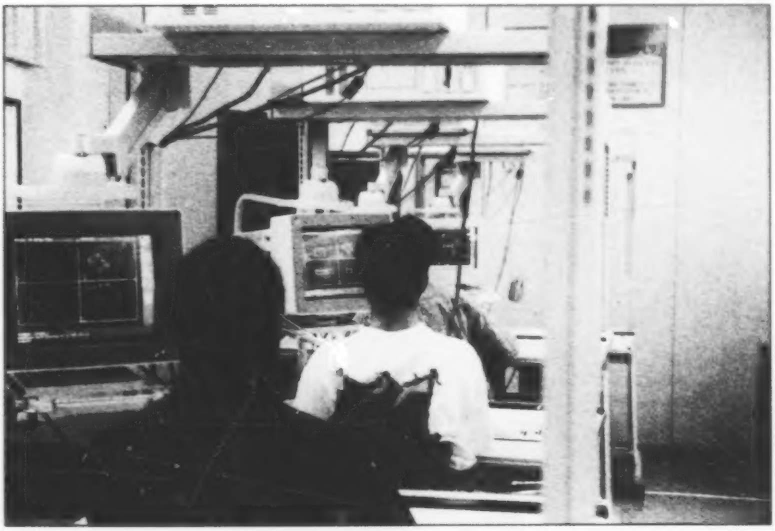

Ramona Newton Hao

Looking over the shoulders of students.

I walk over. The student is looking at a screen displaying a ranchstyle house. The lighting over the house gradually changes. "The computer is showing how the light would fall during different times of the day. This helps architects decide whether the house is oriented on the property the best way with regard to the sunlight," Bob explains.

There seems to be a problem with the program. The student reads something off the screen: "*Merge.* What does that mean?" Bob explains and then they try all sorts of commands, without success. Finally Bob suggests, "Let me work on it some this afternoon and see what's happening." Apparently, glitches in the program are not uncommon.

"The students are working so independently," I marvel.

"Yeah, they're finishing their projects for this portion of the course. So they should know what they are doing."

A group of visitors comes through the glass door—visitors to this model classroom are common. This is a group of Kamehameha Schools counselors who want to learn more about the courses their high school students take. "Wow! This is really scary," one of them blurts out.

Bob explains the history of the place. "They used to call this 'shop,' a place where you could tune up your car or make wooden boxes or build a simple electric circuit, a place where you got dirty and forgot about your

Ramona Newton Hao

Ramona Newton Hao

Above: Bob explaining the program to counselors.

Left: Counselors asking a student about his AutoCAD work.

hard subjects. It had a certain atmosphere and attracted a certain kind of student. We still have shop, but we have so much more than that now.

"Over the past 20 years, we've gone from basic vocational training for particular jobs to preparing students for college or for any number of different technical careers. Partly, this change has come about by offering a much wider series of courses including, for instance, computer-assisted designing and drafting. Partly, the change is the product of adopting a different approach to teaching. Now we want them to have the theoretical knowledge as well as the ability to apply this knowledge to practical situations. Our students do projects, and although the finished product is essential, we believe most learning happens while doing the project: the projects are the medium for teaching scientific principles. We ask students to think and to problem solve, rather than just tell them what to do, hoping they will be able to transfer what they have learned to a wide variety of careers they may strive for later in life."

Bob looks proudly around the room, and waving his hand, he continues. "In this room is the best architectural technology in the state. We have a series of courses for students who are interested in engineering, architecture, or facility management. The first course is a year of designing and drafting technology, a course in which students learn the graphic language of the tool and construction industry. They learn the fundamentals and principles of sketching, lettering, designing, and drafting. In the second year, they learn to use AutoCAD. After this course, they can take advanced courses that apply AutoCAD for architectural and engineering uses.

"These courses help our students in their applications to architectural or engineering schools, which often ask for portfolios of student work. So our students can use the drawings they have done in the AutoCAD classes."

One of the counselors is curious: "Does this mean that the students are learning a marketable skill, that they can get well-paying, part-time work while they're in college?"

Bob tells them with pride about a student who was hired right out of high school by a local architectural firm to work with the Euro Disney project. "They even paid his way and stay in Europe."

The group leaves, and I have a chance to bombard Bob with questions about his teaching goals. Bob explains, "These students here are in the AutoCAD introductory course. My goal is for them to become familiar with AutoCAD and to learn very basic applications to engineering and architectural designing. I want to prepare them for a variety of college designing programs."

I'm puzzled: "So the purpose of this course is to learn to use AutoCAD?"

"Uhum."

Being a newcomer to all this hi-tech, I can't fathom why students should be taught a software program for a whole year of their high school education. I try to understand what the process is like: "What do you have the students do?"

"They learn how to draw using the computer. The computer program has its own language. For drawings, you may start with solid primatives, such as boxes, cylinders, and cones, and to these you subtract or add, called *union*. Every design is made of combinations of these primatives.

"At first, the students don't do their own designs but learn the procedures and systematic approach to setting up the parameters in their computer so they can replicate architectural or engineering plans." Bob points to a complicated architectural plan on the wall. "For example, they'll learn how to replicate this drawing where they have to make designs with different layers."

Bob continues, sensing that I still cannot grasp the wonder of all this. "I usually have students do projects; I go through a cycle. First, I lecture and tell them what the project is about, for instance how to create layers. Then I take them through a problem, telling them what to do and why they are doing it. This should give them an understanding of the process the program goes through. Next, I have the students do an almost identical problem; now they should be able to work more independently. For the final assignment in the series, I give them a problem that is essentially the same as the first two but with an additional two or three steps I didn't take them through. I want to see whether they can figure these out on their own. They should be able to by applying what they've learned. For example, I might have taught them how to make two layers; now they need to make something with three layers. I don't worry about the mistakes they make; the important thing for me is that the student has gone through planning, developing, creating, and often presenting a project.

"I try to challenge the students with these problems, and I encourage them to help each other. They do a lot of that. It's fun to see how they think and how they come up with different ways to solve the same problem. There is some memorization of terms—but at the same time they learn how the computer does the procedure. They begin to understand how the program thinks, what steps it takes, what its logic is."

"What does the program allow students to learn and do now that they couldn't before?" I wonder out loud.

"They can be so much more creative and productive; they have many more options. There is no need for fine motor coordination, which used to be a miserable stumbling block in design and drafting for some capable students. Their drawings are more accurate, and they can do everything so much faster; they now have more time for creative thinking and assimilation of ideas.

"In the advanced AutoCAD classes, I give projects in which students need to apply the more abstract knowledge they get in other areas. I might have them design an office space. I show them how to draw the office spaces and the entry ways. Then I give them the parameters: 36,000 sq. ft. of space, 10 clients, 5 need 2,000 sq. ft., men's and women's restrooms, a hallway, and each office needs to have a separate entrance from the hallway. Although I've given them the tools for working out this project, the actual thinking and designing has to come from them. And each one will come up with a different floor plan."

I leave the classroom … dazed. I'm not sure what I think of it all, what I feel about what I saw. It's all so new—a visit to another planet. Here is a miraculous computer program that can create, from a floor plan, a building that can be viewed from any angle you wish—the inside, the outside, the front, the back, the top—maybe even the bottom!

I remember Bob's words. "Now an architect merely has to decide on what kind of windows he wants, ask the company for their AutoCAD drawings of the windows, insert them into his floor plans with a click here and a click there, wherever he would like a window to go. He can then take a walk—on the computer screen—through the house to see whether he likes his window placement. The program even gives the immediate cost of having those windows." Actually, all the building codes can be inserted into the program. What is there left to do for an architect?

I think of my 17-year-old son, a high school junior. He's interested in architecture, but he hasn't had, and will not have had, AutoCAD before applying to college. Won't he be at a disadvantage? Will they even consider his application?

Other thoughts arise. Why should one spend so much time on teaching one computer program? Wouldn't it be more important for students to learn engineering principles and concepts rather than a computer program?

But, one thing is clear—the students love to work on this program; they're totally absorbed! No lack of motivation here!

I share my confusion with my colleagues. One of them tells me her son, Lance, took drafting at Kamehameha Schools 15 years ago and had learned an early version of AutoCAD at college. Maybe a chat with Lance will help me understand why high school students should spend several years taking computer-assisted design and drafting.

Lance[2] shares details about hand drafting, and I discover what an intricate skill this is or … was? It takes an incredible amount of small motor coordination. Think about trying to draw a line of even thickness by touching only the tip of the pencil to the paper with the rest of the

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Lance's high school drawing materials.

hand suspended in air—and twirling the pencil as you draw! This is what a draftsman does—hour after hour. The suspended hand is to prevent smudges or oily spots. The twirling pencil is to keep the pencil sharp in order to make a line of even thickness throughout its length.

Mistakes are a bit of a catastrophe. How can you erase without touching the paper with your hand and without erasing other lines that had been so carefully drawn? To help, draftsmen have come up with a neat gadget, an eraser shield with cutouts of different shapes and sizes; placed over the section to be erased, it keeps the rest intact.

Different shades of lines signify different things in this language of engineers, and the draftsman must know which hardness of pencil to choose for which parts. For the lightest lines, hard-lead pencils are sharpened with sand paper! Lettering by hand is intricate—letters must be evenly sized and spaced and fit in the available space. I begin to grasp that technical drafting is a high level skill, requiring much practice, daily practice. A draftsman is like a musician who must practice his instrument daily.

Lance tells about his high school days. Drafting and computers were separate back then. For drafting, two students worked together at a desk. The teacher would start the class by explaining something new. On an overhead, the teacher would make a drawing that incorporated the new skill. The drawing would then be mounted on a table, and the students would line up to make a rough sketch and take the necessary measurements in order to replicate it. To do this, they used special rulers for drawing things to scale and compasses and protractors for measuring the angles.

This meant waiting and waiting in line… *the* opportunity to chat and fool around. When the teacher wasn't looking, it was natural for the triangles to turn into frisbees and the art gums into cannon balls!

Students used to be graded, not on any creativity in their drawings, but on precision and neatness. Minor flaws, such as a line a bit too long, an arrow not drawn with the right thickness, letters touching the frame, an ellipse without all the supporting protractor lines, would mean points lost.

"All this practice and pickiness and fine-motor control got to me," Lance confided. "After several years of drafting and designing in college, I burned out. Also, I realized that what I had taken years to master had become an obsolete skill before I even graduated from college. The computer can do it so much faster, so much more precisely, and it can make all the variations in drawings you need. With AutoCAD, we can do in a few seconds what we used to take days to draw."

I was beginning to see that Bob's AutoCAD students—some only sophomores—were learning the skills that will be required of the modern draftsman. How many engineers and architects are struggling to learn this complicated AutoCAD program? Teaching the students this computer program is a worthwhile goal!

Equipped with this insight, I decided to spend some more time watching the students in their AutoCAD classes. I catch the beginning of a period. Students walk in one by one, go to a computer, call up their program, and start working right away.

After a while, Bob gets their attention. "Last time you learned to set up different viewports…Think in three dimensions: think of Xs, Ys, Zs…. And remember when you do the text, the text height is .25 and stick with the same text style and text height; otherwise you're gonna get all jumbles."

A bit later, he adds another hint: "Sol-union pulls them together; Sol-sub pulls them apart." One student carries out these magical commands, and there on the screen his design takes on the desired shape: a box with two cylinders on either end. "Yahoo!"

That's about all that Bob says to the whole group. He begins to go around the classroom. The students are busy working. Each has a paper with six different drawings to replicate.

For this particular assignment, the screen is divided into four distinct parts, called viewports. Each shows a different view of the object being

Ramona Newton Hao

A student working on a problem utilizing four viewports drawn: the top view is shown in the top left quadrant, the side view in the bottom left, the front view in the bottom right, and in the top right quadrant is the *isometric* view, or what Bob calls the layman's drawing, which shows the object diagonally from above. This is the drawing that will need to look identical to the one on the students' papers.

I notice that when a change is made to one viewport, it appears in the other three. In other words, only one set of commands is required to make a change on all four views simultaneously. For instance, if you press Shade, all four designs are suddenly shaded. What a time-saver! Rather than making four separate drawings—which is what draftsmen used to have to do—the program allows you to create all four drawings at once.

Occasionally this advantage can also be upsetting. Once, a single keyboard stroke made nearly everything disappear on all four viewports. "Oh no!" the poor student cried. But a press of Regen made everything magically reappear: "Yes! Yes! Yes!"

Collaboration and peer assistance is everywhere. I try to listen in and write down some of the dialogue. A student, I'll call him Kaipo, has been helping Kahele to do a design. Just as they finish it, a third student calls out to them, "There's another way of doing the problem," and he swivels his monitor around so that the other two can see his screen.

Kahele asks, "How did you do that?"

The student demonstrates on the computer.

"Oh, cool!"

After several minutes, Kaipo asks Kahele for help: "I gotta pick the midpoint of this line?"

Kahele is now the guide, talking Kaipo through a sequence of steps. "The diameter is 1! Press C for center. Then press Midpoint of back line. Then the next one....the other circle....use your back circle....Go Solcyl again and use the Midpoint of the back one."

"This one?"

"Yeah! . . . Now you're gonna tell it your diameter is 3. The center is going to be .5."

"Push C?"

"Use your mouse." Kahele moves over to Kaipo's computer and handles the mouse and works on his keyboard.

After a few more minutes it becomes Kaipo's turn to help. Mark, who sits in the row in front, turns Kaipo's monitor around so he can see what is on it. He compares his own screen with Kaipo's and notices something is wrong with his design. Mark asks, "How did you do this?"

Kaipo isn't quite sure and goes back to the command line for that earlier design to see how he solved the problem. He flips back to the actual drawing, clicking his arrow on parts and moving back to the command list. Then he goes over to Mark and does the commands on Mark's keyboard, explaining what he is doing.

I begin to see what Bob meant when he said that there's a lot of problem solving going on. I've been watching a girl for a while. She has difficulty getting the computer to do two things: drawing a smaller circle into the larger circle (actually, showing a cylinder in 3-dimensions) and making the second cylinder face downward rather than upward. A friend comes to the rescue and explains what to do; as he gives her the commands, she carries out the steps. She will have many more projects that build upon today's, so I don't worry about the fact that she did not do this on her own.

The task Bob gave them is not easy. I watch another student, Kuhio, struggle. For several minutes he seems to work randomly: he looks at the original drawing, presses a few commands, looks at the screen. Things appear on the screen that he doesn't want, and he presses U for undo. He looks back at the drawing, presses the keyboard, things disappear, and he types Regen. My heart goes out to him as I stand looking over his shoulder. Maybe he senses this. He turns to me for help. I'm embarrassed to admit, "I don't know anything about this program; I'm just watching what you're doing."

Finally, he turns to a friend who barks a few brief instructions. I don't follow the jargon but notice that everything disappears on Kuhio's screen, and he starts anew. Wow, did he need to do that? Won't it take a long time to redo everything? I'm wrong. Within five minutes, he has replicated the drawing on his screen and is lettering it. He's finished and immediately goes on to the last problem.

As I watch the students trying to master this program, I think of Vygotsky's[3] concept of *zone of proximal development* and his assertion that children's minds and abilities develop when they are problem solving under adult guidance or in collaboration with more capable peers. Here is the perfect example!

Does this new kind of high school course require a new kind of teacher? What preparation did the teacher of this very advanced, complex computer program have? How does he stay current in this field of swift change?

Two students problem solving together

Bob's background was in high school electronics and automotive, not in design and drafting. Several years ago, the drafting and designing teacher at Kamehameha Schools realized that computers would be changing the field of designing, that it would go from hand drawings to computer drawings. Nobody believed him. But when he showed Bob what the computer could do, Bob was convinced this was the way of the future, that it would be his future.

Bob recalls: "It was very difficult to learn about these computer-assisted designing programs—there was no training available. I had to teach myself. So I went through the AutoCAD manuals, trying things out and trying to understand the logic of the program. I spent many weekends and even two weeks in the summer of my own time learning. And while I was learning this program it kept changing and developing!

"Once I could use the program fairly easily, I decided to write the curriculum. I mapped out the progression of skills for the course. The progression for learning AutoCAD is so different from that for hand drafting: some designs are very difficult to draw by hand, such as ellipses, but very easy with the computer. I searched for designs that supported the progression of skills in mastering the program; I looked for designs students could relate to and that would help students learn the program. Finding designs that met these criteria took a lot of research. I looked at engineering and architecture textbooks, at actual products on the market, at designs we had used in the drafting course. Now I have folders and folders of projects to use with the students. All the designs are of actual mechanical parts and products.

"Although I've developed fairly solid curricula for introduction to AutoCAD and for more advanced applications to engineering and

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architecture, I still spend at least an hour-and-a-half each day looking for new materials and ideas. I'm always looking for something better. I also still spend time learning more about the program itself. My learning never ends."

New technology! New Curricula! New skills to learn! New kinds of teachers!

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**Footnotes**

[1] AutoCAD [Computer software]. Autodesk, Inc.

[2] I want to thank Lance Hao for helping me to understand the nature of hand drafting and the implications of computer-assisted designing programs on the architectural and engineering profession.

[3] Vygotsky, L. S. (1978). Mind in society (M. Cole, V. Steiner, S. Scribner, & E. Souberman, Eds. & Trans.). Cambridge, MA: Harvard University Press.

# The Electronic Student Portfolio

**Emily Fasick**
**Clemence McLaren**

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***Emily Fasick,** a former teacher of computer applications, vocational education, and mathematics, is Assistant Coordinator, Office of Curriculum and Instruction at Kamehameha Secondary School. She is researching electronic portfolio models for her doctoral dissertation at the College of Education, Unive[illegible] of Hawai`i.*

***Clemence McLaren,** a writer of fiction and non-fiction, is a reading teacher at the Kamehameha Secondary School. She has taught courses in the College of Education, University of Hawai`i, and is an administrator for summer residential programs at Johns Hopkins Center for Talented Youth.*

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> *If you value the learning process,*
> *the product will take care of itself.*

A portfolio in its simplest form is a collection of material over time. When we think of a portfolio, the financial portfolio is perhaps the most familiar. These portfolios contain information about a client's investments, including stocks, bonds, and mutual funds. Portfolios are also used by artists—drawings or paintings are collected in portfolios to be taken to prospective buyers or agents. Models collect photos of representative poses in portfolios for presentation to prospective agents. Common to portfolios is the fact that they tell a story about their owners who are the ones to decide what to put into them.

Why should portfolios be used in education? We have seen the traditional classroom with standardized tests, teacher-generated activities, and rote memorization evolve into the constructivist classroom. Teaching methods such as whole language, process writing, and thematic math and science involve all parts of learning and encourage students to become active

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learners. As a result, traditional measures of learning such as standardized tests and grades are no longer adequate, and portfolios are becoming a promising assessment tool.

The range of uses of portfolios in education is wide, its definition varying from being "a collection of almost any stuff for almost any purpose for almost anyone"[1] to "a purposeful collection of student work that exhibits the student's efforts, progress, and achievements in one or more areas."[2] The portfolio that is just a container for "stuff" doesn't tell us very much about the student or about student learning. Its purpose may be to simply collect bits and pieces, similar to a shoebox into which photos are tossed. However, the portfolio that involves the student in its creation would show the progress of the student over time and would include the processes as well as the products of her learning. It is this portfolio to which we direct our attention.

Can technology be used as a medium for collecting portfolio materials? Most portfolios are contained in manila folders or boxes. Each year, the collection grows and creates a storage problem. Portions of the portfolios could be misplaced or lost over the years. Sometimes, the teacher gives the student the portfolio to take home at the end of the year. In this case, there is no record or copy at the school. Today's electronic technology, such as the computer and its various peripherals, may be a solution to this problem. An electronic portfolio could provide copies to students, parents, and administration. It would take less space—a computer disk versus a bulky manila folder.

Teachers at Kamehameha Secondary School have been encouraged to create and use student portfolios. In the English department, students select two pieces of writing each year. These samples are placed into portfolios and are passed on to the next grade as evidence of growth in writing. However, the management of such portfolios is a burden: the extra time required and the handling of additional materials just add to already busy schedules. Some of the teachers have wondered why technology couldn't be used to collect these samples.

For my doctoral dissertation at the University of Hawai'i, I decided to develop and test a model of an electronic portfolio. What, if any, are the advantages of an electronic portfolio? Would it be worth the time and effort to create it? What is its value? Thus, at present I am conducting a pilot study at Kamehameha Secondary School with students from Clemi McLaren's Individualized Literature class. Clemi and I will share the first component of the model we are piloting.

## The Teacher's Story

Individualized Literature is a senior English elective that was ahead of its time. A recent metastudy of successful reading programs found that two major elements promote growth in reading: choice of books and time to read. And that's how this course has operated since the early '70s at Kamehameha Schools—students choose their own books and read them during the class period.

The course's current format requires that students write a weekly journal, reflecting on their reading. We try to wean students away from retelling the book's plot—usually in exhaustive detail—a habit that's often hard for them to break (but very necessary before they reach college). We encourage them to make connections with situations, characters, and ideas in their books; to write about their own similar experiences; to measure themselves in terms of a particular character's courage or anguish. For example, reading a historical account of Hawaiian warriors following their chief to battle, one boy wondered about the source of such loyalty and wrote about whether he, knowing he was likely to die in battle, would have the courage to follow his *ali'i*. Another student empathized with a main character who watches his girlfriend dancing with his best friend.

In addition to the weekly journal, several other methods of monitoring achievement are used for this student-centered curriculum. Students have a weekly "page requirement" that is a function of their reading level. Whenever they complete a book, they conference with the teacher. And then there is the course final exam.

Formerly for this exam, I asked students to identify five criteria for judging a book, to apply these criteria to two of the books they had read, and to support their opinions with examples and quotes. The exam enabled me to evaluate not only how well my students had mastered the course goals but also to evaluate the course itself. Actually, the majority of students did an excellent job of analyzing literature, of describing what works and doesn't work, and of supporting their assertions with examples and quotes. They knew the terminology for analyzing literature—plot, setting, description, characters. They were even able to give reasons for why they considered a piece of literature valuable.

This semester, however, Emily persuaded me to pilot an electronic portfolio. We decided to make the portfolio a part of the final exam requirements. After students had written four or five weekly journals in the usual manner, I gave them the portfolio assignment. They were to look through the journals they had written and pick two journal entries that best represented their growth in reading during this course and to explain why. To help them choose representative journals, I described the behaviors they were to look for in their journal entries. These behaviors are shown in Table 1.

### TABLE 1

1. Enhanced engagement with books
   - Students relate text to their own ideas, experiences, and problems.
   - Students can better understand the world through their reading.
   - Students connect characters and themes with larger issues.
2. Enhanced synthesis, analysis, and evaluation skills
   - Students can apply the literary analysis terminology and concepts they've learned about in previous English classes; can compare one author's style with another author's style; can attend to structures of the text, describe plot development, major characters and influence on one another, setting's relationship to both character and plot, etc.
3. Enhanced ability to challenge and reflect critically on texts
   - Students can construct original arguments and support statements of opinion with specific examples and/or quotes drawn from the reading.
4. Developing the habit of reading
   - Students develop the patience to sit and read a book. Some express confidence and even enjoyment.
5. Improved vocabulary
   - Students learn new words in the context of their reading.

Based on these two journal selections, the students were to create with multimedia technology a presentation about their growth in reading comprehension and their enjoyment of selected literature pieces. They would be able to use state-of-the-art computer technology that would allow them to narrate their rationale and produce visuals of their actual journal entries.

Emily demonstrated the technology that the students would be using for their multimedia presentation of their portfolio. Multimedia presentations require making a plan about how the various media elements will be used to communicate. This plan is called a storyboard. Emily passed out sample storyboards[3] illustrating a hypothetical journal entry and a plan for creating a presentation. Still, none of us were clear about what the students were going to be doing. I had used a similar assignment with my education students at the University of Hawai'i, but without the electronic multimedia presentation. I wasn't at all sure what these electronic versions would look like and how I would access them to grade my students. All this technology seemed to be cumbersome and very time consuming.

At least two students saw the project as a waste of time, but most were open-minded or positive. One girl in particular, Julia, took off with the assignment. She immediately went beyond just scanning in journal passages and explaining the learning they represented. She began scanning in personal photographs that related to the thoughts and memories the literature had called forth in her. She embedded a photograph of her uncle in his 442nd uniform in the picture of the jacket of a book about Japanese internment in World War II. Talk about engagement with the book!

In the two weeks that followed, a handful of students straggled into the lab and began to create their title pages for the portfolio. A couple went over their storyboards with me. As I conferenced with students on completed books, I would point to passages in their journals and suggest how these could be used to show that they were analyzing and engaging in literature. But only a few students were really working on the assignment. I think they were dragging their feet because they were bewildered with the assignment and because of "senioritis"—the typical slacking off in the last months of senior year.

Finally, the day before spring break, we gave students a deadline on the storyboards. We also took them down to the student multimedia room to show them Julia's evolving portfolio. After that, students worked attentively on their storyboards and helped one another. Their biggest difficulty was to write about *how* the journal entries represented their own learning. This reflection on a reflection appeared to be very hard.

As the project comes to a close, I'm much more positive about it. It provides the opportunities for metacognition that I want for my students. And as an electronic portfolio that allows for a multimedia presentation of its contents, it offers greater opportunity for self-direction and creativity, and for mastering a new and probably essential technological medium. For students who entered the course as avid readers, this project has provided an extra challenge in what might have been a "cruise" course.

The one thing I question is the additional freedom students have to go to the multimedia room in an already self-directed course. Some students are not ready to handle that much freedom of choice. With 26 students and my need to conference with them individually during class time, I cannot police them. Clearly, some students are using the freedom to sit and talk outside the library instead of working on their portfolios.

## The Researcher's Story

At the outset of our study, we gave students a questionnaire to find out what they knew about computers and what they used them for. Some had had previous experience with multimedia projects, but most had only had basic computer experience, usually word processing. A number of students indicated they wanted to learn more about other uses for computers.

Our initial idea was to pilot a simple electronic portfolio for student work to make storage, duplication, and transportation easier. Soon, however, we realized that we wanted to create a model that was more than just an electronic database. Together with Kamehameha Schools' curriculum integration and technology consultant, Shawnja Yamaguchi, we developed the portfolio model we are presently piloting.

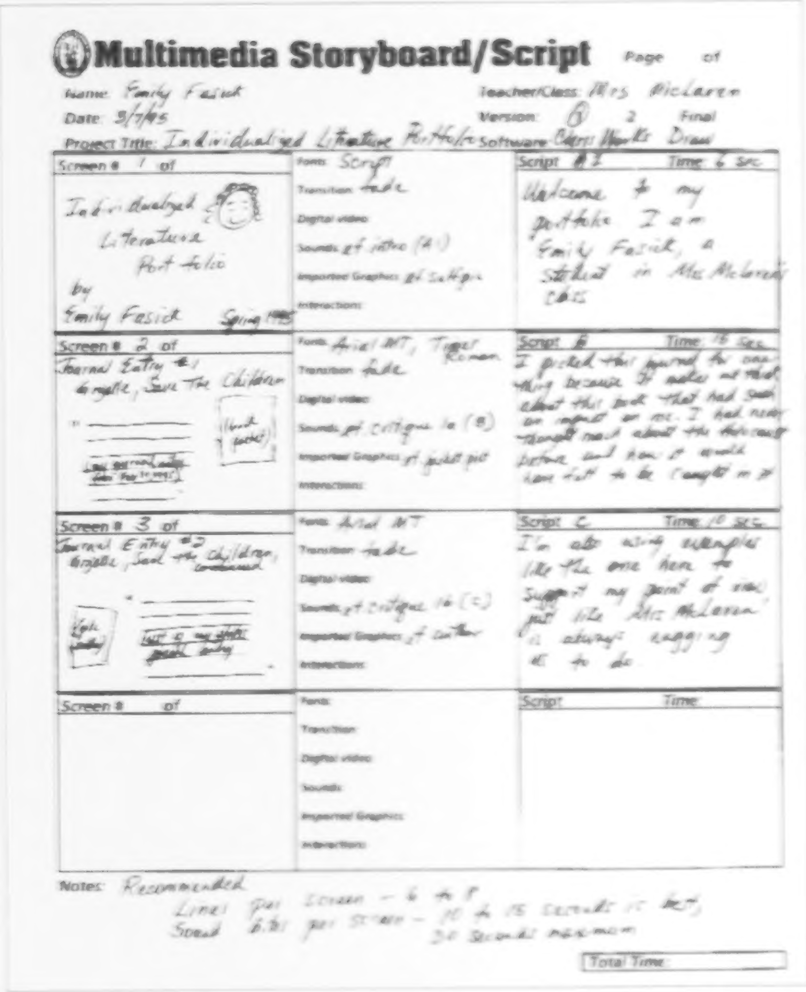
We decided to use hardware and peripherals available in the student multimedia room[4] and to use the drawing program in *ClarisWorks*[5]. We wanted to show that an electronic portfolio could enhance learning without using highly specialized or expensive software.

After the teacher had introduced the project to the students, I explained the role of the storyboard in planning multimedia presentations. To help them visualize the concept, I prepared a sample storyboard, taking excerpts and reflections from previous students' journals. They were to view this technology as a tool to help them communicate their reflections, their history of learning.

Shawnja, assisted by Maile Loo,[6] gave the students an orientation session to the equipment in the multimedia room and helped students whenever they worked there. Tip sheets for using *ClarisWorks*, recording voice, and scanning images were also available.

We encountered problems along the way. A major obstacle has been lack of preparation: the students should have spent more time on planning and on completing the storyboards before starting the projects in the multimedia room. Lack of motivation to complete the multimedia part of the project was another problem. This may have been due in part to our grading system, in part to the fact that it was their final semester in high school, and in part to lack of clarity in the assignment and due dates.

However, even with our rough start, we are excited about this project. It has all the advantages of an electronic database we mentioned at the



## Multimedia Storyboard/Script

Page of

Name: Emily Fasick
Teacher/Class: Mrs McLaren
Date: 3/7/95
Version: [✓ 1] 2 Final
Project Title: Individualized Literature Portfolio
Software: Claris Works Draw

| | | |
|---|---|---|
| Screen # 1 of | Fonts: Script<br>Transition: fade<br>Digital video:<br>Sounds: pf intro (A1)<br>Imported Graphics: pf self pic<br>Interactions: | Script A Time: 6 sec |
| Individualized Literature Port folio<br>by<br>Emily Fasick Spring 1995 | | Welcome to my portfolio. I am Emily Fasick, a student in Mrs McLaren's class |
| Screen # 2 of | Fonts: Arial MT, Times Roman<br>Transition: fade<br>Digital video:<br>Sounds: pf critique 1a (B)<br>Imported Graphics: pf jacket pict<br>Interactions: | Script B Time: 15 sec |
| Journal Entry #1, [illegible], Save The Children<br>(book jacket)<br>Last journal entry Feb 1st 1995 | | I picked this journal for one thing because it makes me think about this book that had such an impact on me. I had never thought much about the Holocaust before and how it would have felt to be caught in it |
| Screen # 3 of | Fonts: Arial MT<br>Transition: fade<br>Digital video:<br>Sounds: pf critique 1b (C)<br>Imported Graphics: pf author<br>Interactions: | Script C Time: 10 sec |
| Journal Entry #2, [illegible], Save the Children, continued<br>(book jacket)<br>last is my other journal entry | | I'm also using examples like the one here to support my point of view just like Mrs McLaren is always nagging us to do. |
| Screen # of | Fonts:<br>Transition:<br>Digital video:<br>Sounds:<br>Imported Graphics:<br>Interactions: | Script Time: |

Notes: Recommended
Lines per screen – 6 to 8
Sound bites per screen – 10 to 15 seconds is best, 30 seconds maximum

Total Time:

outset. The entire portfolio can be transferred onto videotape that can be shown on any video player. Copies can be made for the classroom teacher and for the student. The portfolio can also be printed. One student plans to use her portfolio as a scrapbook.

In creating their own electronic portfolios along the guidelines we developed, students are learning how to make multimedia projects while at the same time they are learning to reflect upon their previous work and to explain why the pieces they have selected represent their growth in

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reading. The creation of multimedia presentations of the portfolios demands careful planning and critical thinking. Moreover, for some students, this multimedia format taps into their creative "juices" and becomes highly motivating.

Although still in progress, we feel that this first component of our model of an electronic portfolio—creating a multimedia presentation of a reflection on the reading growth represented by journal entries—has value and is worth the time and effort required. In closing, let us consider these words from Anne Davies:[8]

> *The challenge of education is to prepare*
> *students for their future, not our past.*

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**Footnotes**

[1] Brandt, M. E. (1993). When are writing portfolios powerful? *The Kamehameha Journal of Education, 4*(Spring), 97-103.

[2] Paulson, F. L., Paulson, P. R. & Meyer, C. A. (1991). What makes a portfolio a portfolio? *Educational Leadership, 48*(5), 60-63.

[3] A storyboard is a planning tool used to lay out a project prior to actually creating it; it is a blueprint of the entire project.

[4] The student multimedia room has four Macintosh Quadras and two Macintosh Power PC's. They each have Bernoulli disk drives. Two stations are equipped with a scanner, two with video digitizing equipment, and two with microphones. Macintosh is a registered trademark of Apple Computer. Bernoulli drives are manufactured by the Iomega Corporation.

[5] It is not uncommon for most Macintosh systems to be outfitted with the integrated software package known as *ClarisWorks*. This program integrates word processing, graphics, database, spreadsheet, and communications programs. *ClarisWorks* is also available on the PC Windows platform. *ClarisWorks* is an Apple Computer product.

[6] We would like to express our thanks to consultants Shawnia Yamaguchi of KidTek and Maile Loo of TeKnowledgy Design Corporation. Their experience, skills, and knowledge, and ability to work with teachers and students are invaluable to us.

[7] It should be noted here that when the computer file is transferred onto video tape, it cannot easily be revised. The original computer file should always be archived.

[8] Anne Davies, Ph.D., works with educators in British Columbia and throughout North America, focusing on issues related to child-centered teaching.

# Video Literacy at Waiau Elementary School

## *A scholarly paper in the form of scripts, storyboards, trailers, and out-takes for videos made, not yet made, and never to be made*

**Ralph Ohta**
**Joseph Tobin**[1]

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***Ralph Ohta**, a graduate of the Preservice Education for Teachers of Minorities Program at the University of Hawai'i at Mānoa, served as Waiau Elementary School's video resource teacher during the 1994-95 school year. He currently is teaching fifth graders at Waiau and writing his master's thesis on the use of parody in media education.*

***Joseph Tobin** is Associate Professor in the Department of Curriculum & Instruction at the University of Hawai'i at Mānoa, where he works with preservice and inservice teachers and teaches graduate courses in qualitative research. His research interests include comparative studies of education and family life in the U.S. and Japan and children's understanding of television shows and movies.*

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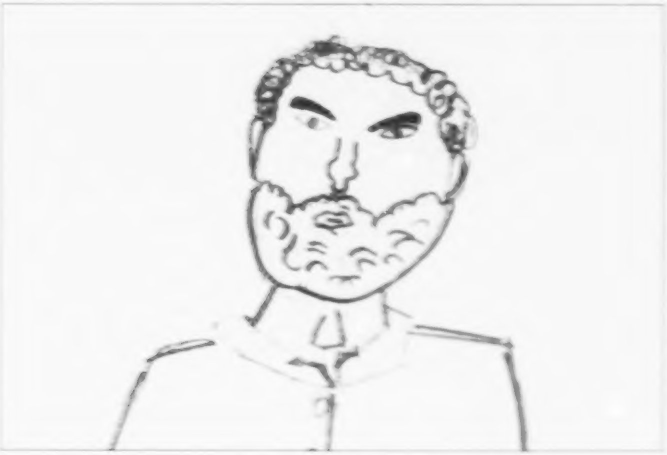
*Screenplay Synopsis:*

This video tells the story of the development of a video-literacy curriculum. All of the action takes place at Waiau Elementary School in Pearl City, Hawai'i. The main characters are Waiau's video specialist (Ralph Ohta), a professor from the University of Hawai'i's College of Education (Joe Tobin), and children and teachers at Waiau. Using a documentary style, the video describes how the project got started, hurdles that had to be overcome along the way, and lessons learned. The video closes with examples of children's work in critical viewing and video production.

The Kamehameha Journal of Education (Summer 1995), Vol. 6, 91-104

# Scene 1: Teachers' Tech-phobia

Type of Shot C.U.    Scene # 1  Shot # 1



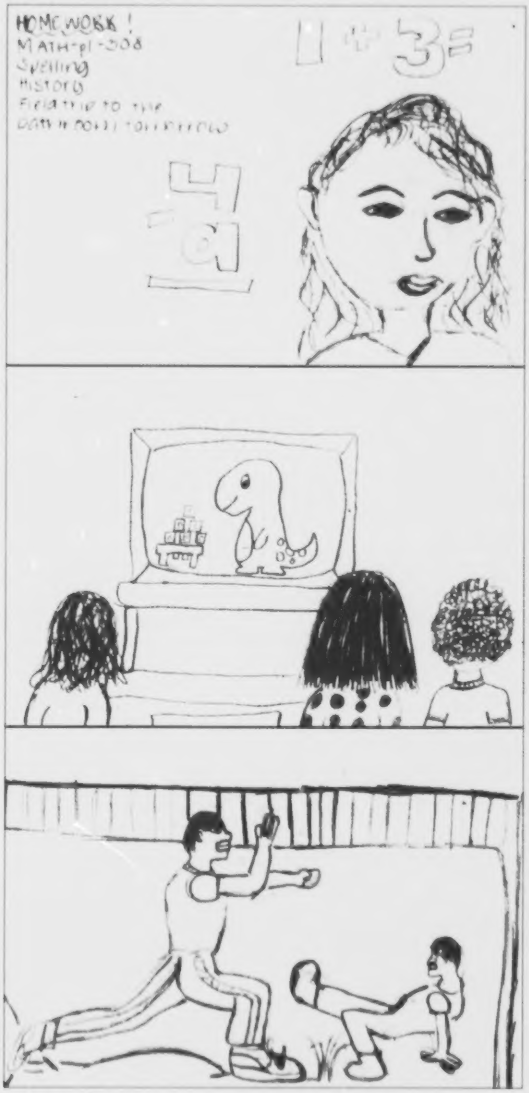
**DIRECTOR'S NOTES:**

Talking head, documentary feel. Joe Tobin talks to camera.

**DIALOGUE:**

Let's face it. Video education can be a tough sell. Teachers often respond skeptically to offers to introduce a video curriculum into their elementary classrooms.

Type of Shot C. U.                                    Scene # 1 Shot # 2-4



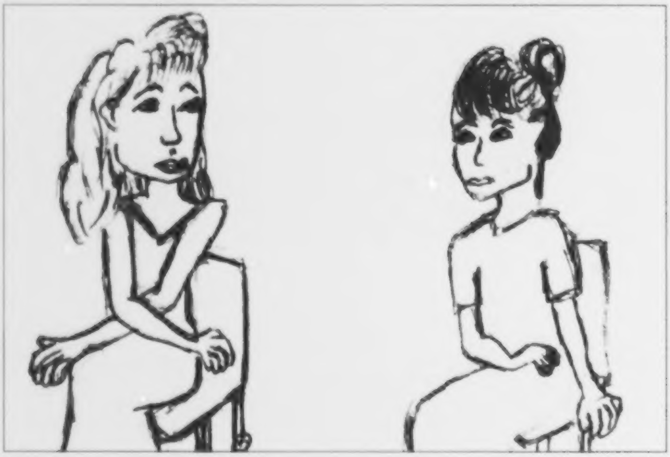
**DIRECTOR'S NOTES:**

Three-shot montage: close-up of a teacher talking to the camera; wide shot of kids sitting "like zombies" in front of a TV in a living room; wide shot of two boys karate fighting on the school playground.

**DIALOGUE:**

**Teacher:** From the time they go home from school until they go to bed at night, my students are wasting their time watching cartoons, stupid sitcoms, and violent movies. Their heads are filled with Power Rangers, karate movies, TV commercials. And now you're asking me to waste precious school time talking about TV and movies when they should be reading books?"

Type of Shot M.S.     Scene # 1  Shot # 5



**DIRECTOR'S NOTES:**

Medium shot of two teachers talking, half to each other, half to camera.

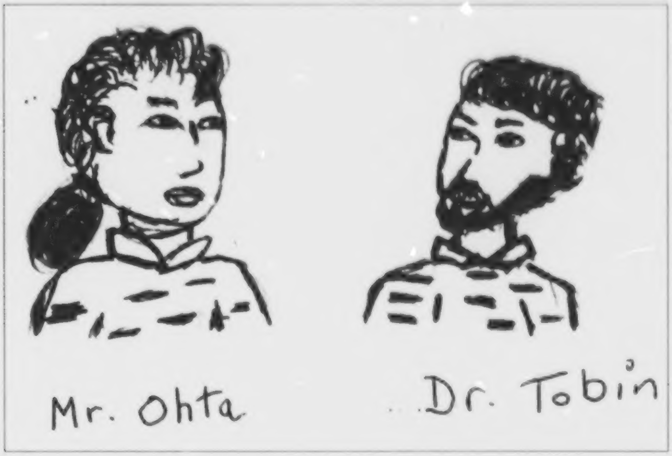
**DIALOGUE:**

**Teacher A:** It's taken me years to get comfortable with computers. And now you want me to teach the kids to make videos? I wouldn't know where to start.

**Teacher B:** Isn't it a bit early to start video education with kids who are still learning to tie their shoes and to write their names?

## Scene 2: Addressing Teachers' Concerns

Type of Shot M.S. Scene # 2 Shot # . 1



### DIRECTOR'S NOTES:

Medium shot of Ralph Ohta and Joe Tobin talking, half to each other, half to camera.

### DIALOGUE:

**Joe:** We understand teachers' technological insecurities. We appreciate their concerns about children's attraction to electronic media. And yet we believe that television and movies should be brought into the curriculum, that teachers can relatively quickly gain the technological competence they need to teach video production and critical viewing, and that kindergarten is not too young to begin a program in video literacy.

**Ralph:** In this program we will make a case for teaching video literacy in elementary schools, discuss barriers to implementing such a curriculum, and describe some curricular approaches to video education we are using at Waiau Elementary School.

## Scene 3: How We Got Started

Type of Shot C.U.        Scene # 3   Shot # 1 + 2

### DIRECTOR'S NOTES:

Close-ups of Ralph Ohta and Joe Tobin, alternating as each speaks.

### DIALOGUE:

**Ralph:** I first met Joe Tobin back in, when was it, 1990? when he came out to our school one day to talk with the teachers about the new "school-within-a-school" program we were starting, and about taking in his OP students. As we got to talking, we discovered that some of us teachers and Joe shared an interest in video. Isn't that how we got started?

**Joe:** Yeah. When I heard that technology, and especially video, was one of the things you guys were considering getting into, I got excited because I had been working with my friend Andy Jacobs for a couple of years on ideas for developing an elementary school video-literacy curriculum. So after brainstorming with you teachers, and with Diana Oshiro, who was principal then, and Judy Eliot, who at that time was vice principal, I wrote up a grant proposal. We ended up getting support from the McInerny Foundation for a two-year start-up project. We were afraid that teaching kids about video might sound kind of frivolous, so in the grant proposal we really stressed that it was promoting literacy through video. We made the argument that the chance for kids to work on video would be a way to hook them, to connect with their interests in order to sort of trick them into doing a lot of writing of screenplays and storyboards, and to use their love of movies to teach them basic reading skills.

**Ralph:** I don't think that was a trick; I mean, not like a lie or a deception. When the kids make movies, they really do learn all that stuff, not only about how to make movies, but also about how to create coherent stories, how to use video to support their arguments, how to choose an appropriate genre. So I don't think it's using video to teach them "the real" literacy. I think there's just one literacy, and it has many facets: books, video, art, music…there are probably a lot more.

**Joe:** Yes, I agree. We started out selling the project by saying it would promote reading and writing, and I think it does. But in retrospect I wonder if, by stressing that video education was for the sake of "regular" book literacy, we didn't buy into the idea that video literacy and media studies are inherently unimportant, not worth learning for their own sake.

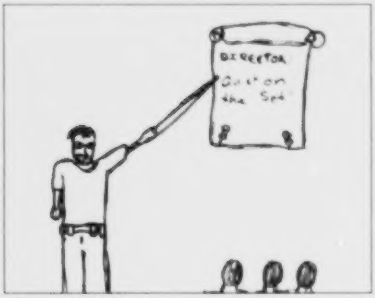
**Ralph:** Like in England. When David Buckingham was here last summer, he described how media education is part of the regular curriculum in Great Britain, that media studies are tied to the study of drama and literature. Kids learn to analyze advertisements, programs, and music videos in school; they even have SAT-like tests for each of these areas. That's where I'd like to see us get in a few years—to have what we are doing accepted as a regular part of the curriculum, instead of some fun add-on or frill.

**Joe:** I think the key is that those of us who already believe in the value of media literacy have to do a better job of selling the concept to our fellow educators at all levels of education. We need to get the point across that video literacy is a way of connecting with students' prior knowledge and interests; of changing them from passive, vulnerable media consumers to active, critical media watchers; and of preparing them to resist media manipulation and the racist, sexist, and violent messages that are so prevalent in movies and television.

## Scene 4: Video-making at Waiau

Type of Shot W.S.

Scene # 4 Shot # 1 + 2



### DIRECTOR'S NOTES:

Shots of Andy Jacobs teaching Waiau students how to direct a video and of Donna Grace talking to students about their scripts. Ralph and Joe voice-over.

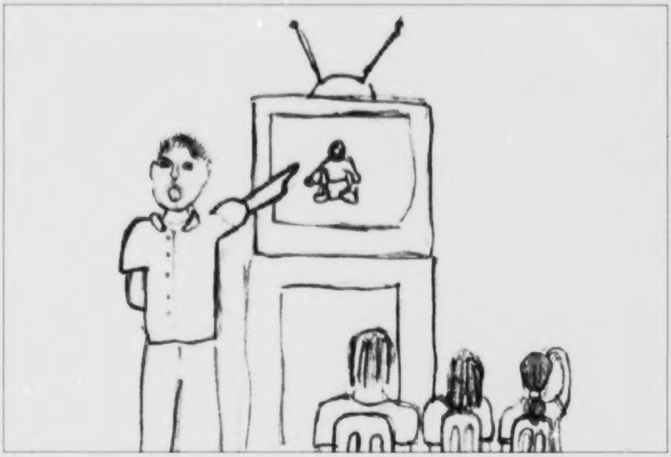
### DIALOGUE:

**Ralph:** Andy Jacobs, who is a video producer, has taught the teachers and students at Waiau the basics of moviemaking. He taught us all how to use the camera, and about shots and scenes, and the concept of storyboarding. He taught how movies are planned and put together, and he stressed the director's role in seeing the project through and keeping everyone on task. Donna Grace, who is writing her doctoral dissertation on children as moviemakers, has worked with the students on their scripts. With this help, the students at Waiau have made all kinds of movies — documentaries, nursery rhymes, versions of award-winning children's books, audio-visual presentations of poetry, and remakings of television shows, commercials, and feature films. Our new idea this year is to have the kids make parodies of various television genres.

**Joe:** There is a lot of concern about the effect that television viewing has on children. Our philosophy is that the best way to make children more critical, resistant, intelligent viewers is to teach them how television shows produce certain effects and manipulate viewers in certain ways.

**Ralph:** The idea behind having the students do parodies is that, to do a good parody, you have to really understand the essence of the genre you are parodying. An effective way to teach children how commercials work is to have them make parodies. We begin by watching commercials together and analyzing them. We identify and talk about the main selling point of the products being advertised, and then we try to exaggerate or twist that point to make the commercial funny. Once we've done a few of these, we review how to use storyboards and callsheets. Finally, the students write scripts and storyboards for their own commercials, which they shoot and edit. We did the same thing with political campaigns last November and with the news.

Type of Shot W.S.                Scene # 4 Shot # 3



## DIRECTOR'S NOTES:

Ralph Ohta teaches lesson on commercial parodies.

## DIALOGUE:

**Ralph:** I'm going to show you a commercial now. I want you to see if you can identify the main selling point of this product. (Shows Huggies® commercial).

**Mandy:** The commercial is about how the diapers can fit any baby.

**Ralph:** Good! The manufacturers are saying that their product is the one most sensitive to babies' needs, because you have the infant stage diapers, the toddler stage, the walking stage. Is that the only selling point?

**Devon:** No. They're also saying…trying to get you to think that their diapers are the ones that can catch all the shi-shi.…

**Leslie:** Yeah, so it won't leak down their leg.

**All the kids:** Yew! Yuck! Gross!

**Mandy:** Yeah, like the other day, that happened with my baby cousin. It was pouring out of his diaper all over the place, and my auntie.…

**Ralph:** Okay (sigh), now that we know the main selling point of this product, how can we change the commercial to make it funny, to, like, exaggerate it in some way to make fun of the selling point? What are some ways you could exaggerate selling points of a commercial. For example, what about exaggerating the Huggies' idea that their diapers can work with older and older babies?

**Leslie:** Oh, like you could have a toddler in a pamper crawling around, and then like a kindergartner walking around in school in a Huggy, then like a big kid in a Huggy…

**Devon:** Or a biker in a Huggy!

**Mandy:** Or a teacher! Wow. Think how big and stinky that diaper would be!

**Ralph:** Yeah, right. Okay. Another way you can make fun of something about the product in the commercial is by making a fake commercial that shows that a product is junk. Or you can make a fake commercial that shows how the people who made the commercial make ridiculous claims, saying things about their product that are way too good to be true. Or you can make fun of the audience of the commercials, showing how the way some people who watch commercials are way too gullible. They believe everything they see in the commercials, and then they will buy anything they've seen advertised.

**Devon:** Yeah,…like when me and my little brother watch cartoons on Saturday morning, and when the commercial comes on for like the G.I. Joe Cobra Pod, it shows explosions, with big explosion noises, and flashes like lighning, and it looks like a real war! And my brother yells to my Mom, "Get me a Cobra Fighter!" 'cause he thinks, if he buys it, it would really be like in the commercial.

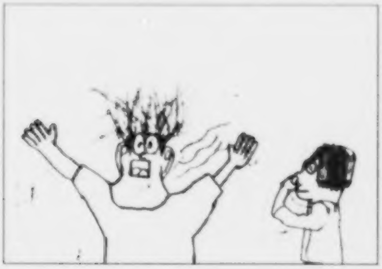
**Leslie:** Or like my uncle bought the Stair Master, and he's still real fat! When it came and he opened it up, he was mad, 'cause it's just like a piece of plastic you step on.

**Ralph:** Okay, for your homework tonight I want you to look for a commercial on TV and look for its main selling point. And then try to think of a way we could make fun of it, make it really outrageous. Then tomorrow, you can start working on your own commercial parodies. So I want you to start thinking of some outrageous products you could make commercials for, or some ordinary products you could make outrageous claims about.

## Minty Hair Spray

A commercial parody created and videotaped by Grant Mochizuki, Sean Wheeler, and Joshua Rice, fifth graders at Waiau School

Type of Shot M.S. Scene # 5 Shot # 1 + 2

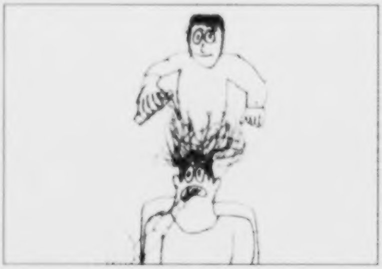


**DIRECTOR'S NOTES:**

Boy with bad breath and messy hair yawns. The other boy smells the stinky breath and holds his nose. The announcer speaks off camera.

**DIALOGUE:**

Has this ever happened to you?



**DIRECTOR'S NOTES:**

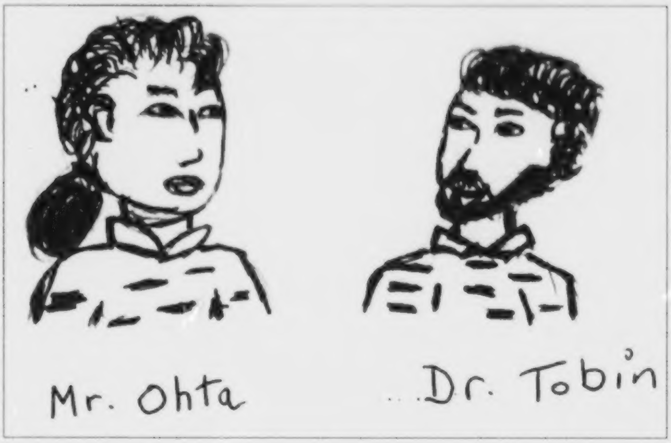
The friend squirts Minty Hair Spray in his friend's mouth and on his messy hair. The announcer speaks off camera.

**DIALOGUE:**

Get the Minty Hair Spray. It will stop these embarrassments. All you have to do is…buy a bottle of the Minty Hair Spray. It's only $55.55.

## Scene 6: In Closing

Type of Shot M.S.    Scene # 6 Shot # 1



**DIRECTOR'S NOTES:**

Medium shot of Ralph and Joe talking, half to each other, half to camera.

**DIALOGUE:**

**Joe:** Since we began five years ago, I'm gratified by the progress you've all made here at Waiau in developing the video-literacy curriculum. I'm pleased that this year the school made a real commitment to video education by making you a full-time instructional resource teacher for video.

**Ralph:** Well, I've been enjoying it, but I may go back into the classroom next year. In the long run, it would be better for teachers to be doing video education themselves instead of thinking they need a specialist to do it.

**Joe:** I think that what you are saying about video education is consistent with what Diana Oshiro has been saying about technology in general since she became head of the DOE's Office of Information and Telecommunication Services. I've heard her say that we need to have a paradigm shift and to get the technology away from specialists and into the hands of teachers, or actually, into the hands of the kids. Teachers tend to be resistant partly because they are tech-phobic. I think gender has something to do with it. Sometimes when I come out here, I wish that you were a woman! I mean, it kind of perpetuates the stereotype when you are the only male teacher and you end up being the full-time video specialist.

**Ralph:** That's one reason I want to go back to the classroom. The teachers are getting too used to me being the one who knows about all the technology stuff.

**Joe:** So you working as a "Video-IRA" this year is in a way a tribute to the success of our project at Waiau in getting media education going. But in another way it shows that we have thus far failed to really get the teachers to buy into the idea that they can do video education themselves, as part of their normal curriculum.

**Ralph:** Yeah. That's why they should take the media education course you offer in the summers!

# A Hitchhiker's Guide to Technology

**Ian Jamieson**

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***Ian Jamieson,*** *Chartered Physicist and Member of the Institute of Physics in Britain, worked for 10 years in industry as a research scientist and electronic engineer before becoming a physics teacher at Punahou. His commitment to teaching physics and to finding ways to make this subject more creative and imaginative stems from his experiences as a student of physics.*

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> *The most wonderful thing we can experience is the mysterious. It is the source of all true art and science.*
>
> —Albert Einstein

Einstein didn't have a great time at school. His teacher told him he would never amount to much. At age 15, he left school and roamed the Tuscany countryside, visiting friends and relatives for a year before his father caught up with him. Of course, the German schools of those days were rather rigorous and not designed to encourage questioning the status quo. Not like today, right?

Einstein believed in "free thinking," which he described as the freedom of the mind to creatively make all sorts of connections without being burdened by previous knowledge. When he attended university, he rarely went to lectures and preferred to discuss physics with his peers. After attaining his degree, Einstein said his interest in science was so damaged that it took him a year before he could think again on such matters. I wonder how many other potential geniuses we are destroying in the education system?

By now, you might be asking yourself what this has to do with technology in education. Well, Einstein went to the Eidgenössische Technische Hochschule, the institute that was at the leading edge of technology in the world at the time. But all that technology didn't do poor Albert much good. I wonder why?

The Kamehameha Journal of Education (Summer 1995), Vol. 6, 105-118

Having worked in research and development in the hi-tech industry for ten years, I have used the most advanced equipment around and have a great respect for high technology and its accomplishments. But I have also become increasingly worried about its application in the classroom. The technology bandwagon is on a roll, and the attitude is, Get on it or face extinction! If you don't use hi-tech in the classroom, you're a dinosaur.

However, there are varying degrees of technology. You can use a rotating stool to demonstrate the *conservation of angular momentum.* Sit on the stool and, with arms outstretched and holding weights in each hand, get a student to spin you around. As you slowly bring in your arms, you will spin faster to maintain your angular momentum. It's like an ice skater spinning with open arms. As she brings her arms in toward her body, she decreases the radius over which her mass is distributed and starts to go faster to compensate, thereby maintaining the same angular momentum.

There are many other examples of using simple everyday objects to demonstrate the principles of physics, and I believe that the current high technology would have a hard job improving on them. Although hi-tech is a wonderful addition, what is important is how we apply it in education. *All the hi-tech equipment in the world is not going to make you a better teacher, unless you use it in the right way.*

I certainly don't have all the answers to the question of how technology should be used to promote learning. I have been trying out various ways in my physics course with the help of my colleague John Proud. The best I can do is to discuss how and why I use technology and to relate my own experiences.

I find it useful to distinguish between high and low technology. I call *low-tech* any device whose mechanism is obvious or clear to see. Take a spring. If you put a mass on the end of the spring, pull it down, and then let it go, the spring will rebound, pulling the mass upward until the spring is tightly coiled again. Eventually, gravity acting on the mass will overcome the force of the spring, and the mass will start to move downward again. As the spring is stretched once again, the force in the spring starts to exceed the gravitational force. When this happens, the mass moves upward again and the cycle repeats itself. As you pull on the spring, you can see the spring stretch and feel the increase in its restoring force. The mechanism is clear for all to see. A *hi-tech* device, in contrast, is anything whose mechanism is hidden, as in a computer interface box that translates real world information into a format the computer can handle.

My philosophy on teaching physics is "hands- and minds-on." The mysterious is my playground. I like to ask a lot of questions and not give many facts. I learned this lesson a long time ago from my five-year-old son when he asked me why things fall. I told him it was because of gravity—gravity makes all things fall downward. He looked skyward for a brief moment and pointed, "Then why do balloons go upward?" Teaching physics should not be like running a restaurant. Never leave your customers satisfied! Leave them hungry for answers.

I want students to discover their own Universe, to get a sense of wonder about this incredible place in which they live. I want them to see how things relate to one another. To do this they have to get out there; they need to observe, to use all their senses; they need to quantify and measure things. More than this, they need to understand and see for themselves the wholeness of their world and how everything is connected through a network of amazing patterns and symmetries. Finally, they need to see how consciousness itself relates to the physical reality of the world. Do we need high technology for students to do this?

In my labs, I give students a problem and, letting them work in groups, I have them design a lab to investigate the problem. For instance, I ask them to determine the mass of a car without weighing it in any way. I usually put out bathroom scales, meter rulers, and stopwatches. Of course, some students will just sit there dumbfounded and ask, "How?" I reply, "Remember those laws we learned last week?[1] Whose were they? Some English chap's, right? Fig something or other."

Then I go and sit in the car to await instructions. Some students weigh themselves on the scales and then proceed to attempt to accelerate the car over a long distance. Others will stand on the scales while attempting to push the car. Few figure out a meaningful way of getting the information. Back to the classroom to work out the result. They remember to ask my mass so that they can subtract it. They appear happy, nay, confident. With zest they announce their results, "10,000 kg!"

"Yikes," I exclaim, "I've got to stop eating those Twinkies."

Back to the drawing board. Cross-group cooperation. Next class we try again. Some are still working on the reference to "Fig something or other." Another group puts one scale on the back of the car, a second scale on the front, and pushes in opposite directions. Nothing happens, at least not to the car. They take readings. They look longingly at the stopwatches I have provided. Finally, one group has a flash of insight. They do the experiment and manage to determine the mass of the car. Other groups follow suit, even though I have said nothing. Social learning is breaking out all over. Maybe Sheldrake was right after all with his morphogenetic fields.[2] One student proclaims, "Long live Sir Fig Newton!"

* * *

Low-tech equipment, hi-tech concept. Physics in the real world is creative and imaginative, so why can't it be the same way in high school? I do not believe in giving "cookbook" labs—the type of labs where students get a list of instructions to follow and are guided to a certain result; I hated those labs when I used to do them. They foster no creative thought, and students cannot wait to get them over with. If they don't get the expected results, they often cheat so they don't look stupid. So, let the students be creative, free thinkers willing to stand up in front of the class and defend their experiment and results.

In determining the mass of the car, the students had limited resources and technology but were able to solve a difficult problem. No amount of technology could ever change the look of satisfaction on their faces when they finally understood how to solve the problem. The frustration, the anger towards me were all worth it. It reminds me of Einstein when he said, "The years of anxious searching in the dark, with their intense longing, their alternations of confidence and exhaustion and the final emergence into the light—only those who have experienced it can understand it."

I prefer technology that I can use in a variety of ways and whose workings are reasonably understandable to students, as for example the coiled spring. With high technology, the mechanism is hidden and the understanding of how it works is often lost. Does that matter? Provided the technology is used to demonstrate a particular principle for which its inner workings are unimportant, there is no problem. If the device is used to collect data, for example, its inner workings are not too relevant, and a lack of understanding them does not detract from the purpose.

Suppose, however, the hi-tech equipment is a mass spectrometer, a device that distinguishes elements and molecules by atomic weight. It is a wonderful device that makes life a lot easier for chemists and physicists, but its operation is beyond the understanding of most high school students. Should it be used by students who are learning to identify substances by analyzing their structure? Here I would draw the line and say no. I do not believe much critical thinking goes on in putting a substance into a machine and allowing it to classify the content. Not only are the inner workings of the mass spectrometer completely hidden, but it is performing all the logical processes the students themselves should be doing.

By now, you will surely appreciate the fine line that exists between using and not using a particular piece of high technology, and teachers will establish a cut-off point for themselves that depends on the level of students they teach. I believe that before using a hi-tech device, students must have some conceptual understanding of what the device is doing.

Otherwise it becomes a "black box" with just an input and an output, and the part in the middle works by pure magic.

With computers, the current hi-tech rage, further fears come to mind. Students could lose touch with physical reality. Moreover, learning is partly a social phenomenon; computers are not very sociable.

*However, computers do have a place in teaching high school physics.* For example, they can be of great assistance in collecting data and in analyzing the data with complicated mathematical calculations, such as linear regression to create *best-fit curves* for a graph. They can also be used for demonstrations and for running physics simulation programs. Here at Punahou, we have been experimenting with how to use computers, and I will share some ways we have found helpful.

## Computers as Graphing Tools

Much of science is showing or discovering relationships between events. Scientists often try to detect the nature of relationships by graphing the data they have collected. Computer programs can graph data and help in the analytic process. For instance, at Punahou we have the *Cricket Graph*[3] program. This program gives the best-fit curve through a set of data points and, thus, lets us see more readily what kind of a relationship exists between the variables we have measured. Since the mathematical calculations of the program are beyond the understanding of most high school students, should we be using this program? I believe the answer is no *if* we ask students to just plug in the data and allow the computer to do the rest. This would again be a pointless exercise.

So, before we let our students use this program, they have to manually graph the relationships between the different variables in an experiment; they have to understand about measurement errors and about drawing a best-fit curve through the data to reduce error. Thus, when they come to use the graphing program, they understand what the program does in principle—the program is just doing mathematically what they have already practiced manually. Moreover, when the computer program plots the graph, it does not know what type of curve it is, what type of relationship exists between the variables. The student must examine the scatter plot and judge what type of curve fits the data—linear, quadratic, logarithmic. Students realize the computer is not all-knowing and that the final interpretation is theirs. Using the graphing program is therefore not a mind numbing exercise.

For example, I might give students the following question: Is there a relationship between how much a palm tree bends and the speed with which the wind is blowing? Intuitively, we say yes, but as scientists we need to put this intuition on firmer ground. So the students go out and measure the wind speed and estimate the bending of a tree branch. They will, of course, have to do this at different times of the day or on different days to get variations in wind speed.

Before we had *Cricket Graph*, students used to manually plot the data they collected and then draw the best-fit line through their scatter plots, often obtaining some funny-looking curve from which they would make a reasoned guess about the type of relationship existing between the two variables: Was it linear or a power, logarithmic, exponential, or root function? For example, their graph might suggest to them that the degree of bending depended on the square of the wind velocity. They would then try to manually plot the graph of the degree of bending against the square of the wind speed. If they got a straight line, they would know it was correct. However, this is a long, drawn-out process and requires several attempts at verification before finding the correct relationship. It takes a great deal of practice and experience to be able to detect this from a hand-drawn graph.

The *Cricket Graph* program, on the other hand, takes students' data and in seconds produces a scatter plot. From this graph, students can then make their judgements about the nature of the relationship and inform the computer; the program goes to work and mathematically calculates the best fit to the data points for that particular function. If the function is the right one, the graph will have a line drawn through most of the data points, telling the student her assumption is correct; if it is the wrong function, the line will miss many data points, telling the student it is not a good fit. The students keep trying until they find the best relationship. Most will get it on their first or second try, since the program is very accurate and gives a much better representation of the relationship than a student could give by hand.

The computer with its program, therefore, has made this lab activity less tedious and much more accurate. And students do not lose any benefits of the conceptualization required by the activity. In fact, seeing how the variables relate to each other graphically on the computer screen is a great visual reinforcement.

There is yet a further benefit to this graphing program. Physics does not deal with truth but with approximations to the truth. All laws of nature are only approximations. Even the most controlled and contrived experiment has experimental error. And here the graphing program is beneficial. By fitting the best curve to the data and thereby finding the best relationship between the two variables, the program has smoothed out some of those errors using statistical methods.

Moreover, the student can see on the screen that the curve does not go through all the points. Why not? Here's a good place to talk about errors and relationships between things. I always stress the point that this is physics and not the idealized world of mathematics. A math graph would be perfect! I have talked about errors and approximations before this point in the curriculum and use this exercise only as reinforcement. To give students an understanding of approximations and measurement error, I usually have them estimate the number of blades of grass out on the football field. Now we're talking errors!

The computer graphing capabilities are also useful for demonstrations of physical laws. For instance, I use *Cricket Graph* to demonstrate the relationship between the height from which a ball bearing is dropped and the depth of the crater produced when it hits sand or playdough. Students can enter the different heights from which the ball was dropped and the depth of the craters produced into the program and can then discover the relationship between the two with a fair amount of accuracy, enough to make sound predictions. They can then plot a graph of the force with which the ball hits the sand against the depth of the crater. From this graph, I ask them to extrapolate and estimate the force of impact of the meteor that created the famous crater in Arizona. To do this, they have to make some reasonable estimates about the velocity of the meteor. Some come surprisingly close to the accepted estimate.

## Computers for Data Collection

Measurement is always accompanied by error; yet the usefulness of experiments depends upon accurate measurement. Consider, for example, the principle of *conservation of momentum*. An object by virtue of its mass and velocity has a momentum that is the product of these two properties; when objects collide, their combined momentum before and after collision is always the same, provided no net external forces, such as friction, are acting on the system.

The typical experiment to demonstrate conservation of momentum consists of two gliders on an airtrack. The almost frictionless surface of the airtrack allows the gliders to move towards each other with no net external force. If we know the distance that a glider has gone in a certain amount of time, we can calculate its velocity and hence its momentum. Thus, we run the gliders towards each other with known initial momentums. After the collision, we measure again the distance the gliders move within a particular period of time, calculate the velocity, and then the momentum.

To be able to demonstrate the conservation of momentum, we must measure time and velocity accurately. Humans, however, are not very accurate at measuring things. First, since we are all different, the same measurement done by different people will yield different results. Second, our eyesight is not very accurate and our reactions are slow.

Computers, however, can have attachments—sensing instruments called *probes*—that take very accurate measurements automatically. For the momentum demonstration, we use a probe called *photogate*. Photogates are placed on either side of the airtrack. The gates are active as long as a beam of light, passing between the two "posts" of the gate, is not broken. When the gliders move through the gates, they block the beam, and the electrical signal from the gate is stopped. A data acquisition unit senses this interruption of the signal and informs the computer. From the length of the glider and the length of time the glider blocks the light as it passes through the gate, the computer can determine the velocity of the glider very accurately—certainly with greater precision than can be done by hand.

Data acquisition units, like the *PASCO CI6560*,[3] have a wide variety of sensing instruments to collect data and display them in the form of a graph or a table. The precision of such computerized data collection can aid students in performing a number of meaningful experiments. For instance, using the glider and airtrack together with a photogate and force probe, the *PASCO CI6560* can compute with great accuracy the velocity of a glider before and after its impact with the force probe. The program plots the curve of the force of impact against duration of impact; the area under the curve (calculated automatically) should equal the change in velocity of the glider multiplied by its mass.

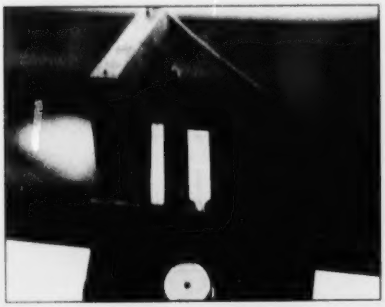
Ramona Newton Hao

PASCO CI6560 Interface on top of the computer

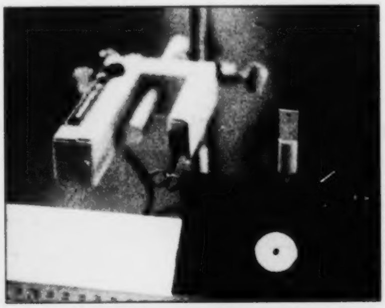
When students use the computer to collect data, there is a danger they may believe the computer and the equipment to be all-powerful and all-knowing. Students should be made aware that the equipment and program are only as good as the user. They should be involved in calibrating all devices to understand the limitations of hi-tech equipment.

Ramona Newton Hao

The airtrack



Close-up of glider passing through photogate



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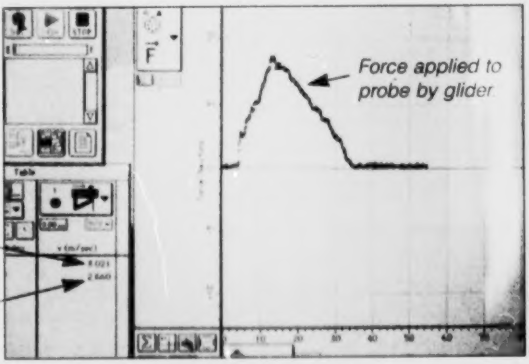
Glider hitting the force probe.



*Force applied to probe by glider.*

*Initial glider 'velocity' through photogate (before impact).*

*Final glider 'velocity' through photogate (after impact)*

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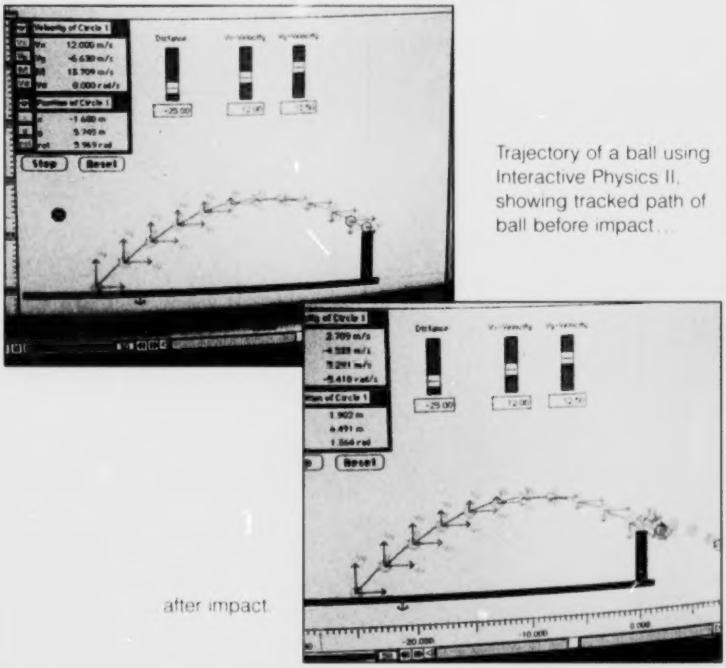
Force probe read-out

## Computers as Simulators of the Real World

*Interactive Physics II*[5] is a program that allows teachers and students to build and see the effects of all sorts of physical interactions. A simple example of how I use this program is to study the trajectory of a ball. Students calculate the initial speed and direction a ball must be kicked to go over a wall. Once they are happy that their calculations are reasonable, they put their data into the computer and run the program to test whether their calculations work. The computer shows the scenario, complete with wall and ball, and the path the ball takes according to their calculations. The students have velocity controllers which allow them to change the speed and direction of the ball.

What is the difference between this and just doing the calculations on paper in the classroom? Students have instant feedback on the accuracy of their calculations. They can see for themselves the path the ball takes and whether it goes over the wall. Moreover, a series of screen graphs and velocity vectors on the ball shows the changes in velocity and the constancy of acceleration throughout its flight.



Ramona Newton Hao

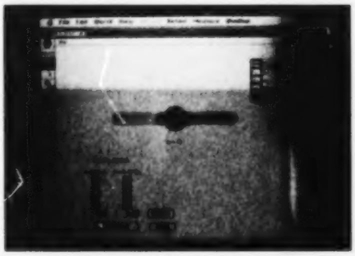
Trajectory of a ball using Interactive Physics II, showing tracked path of ball before impact...

after impact.

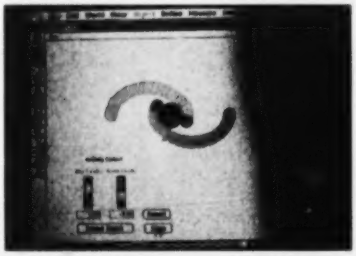
The *Interactive Physics II* program is most useful to demonstrate situations not possible in the lab. An example is the simulation of paths of planets and moons. Let students run the program with a planet and a moon, the moon having no tangential velocity (that is, no initial velocity, as if it had just stopped dead). See the planet and the moon collide! Now give students the masses of the moon and the planet and some value of G—any value you like. What tangential velocity does the moon have to have so it will orbit the planet? The students can set the distance between the planet and the moon and work out in theory the velocity. Once they put their calculations into the program, they can watch on the screen what happens to the moon and the planet. They get quite ecstatic when their solution actually works! They can also see that the solution may be elliptical.

Make the task more difficult by adding another moon opposite the first. Let the students run the program and see some fantastic chaotic patterns emerge. Questions really start to flow. This is the point they can start to learn about chaotic systems and "many-body" problems. Finally, they can simulate the Earth-Moon system; but I leave it up to them to research and calculate the different values. Without these simulations, students would just use the formulas for gravitation and work through problems without ever seeing what their calculations actually mean.

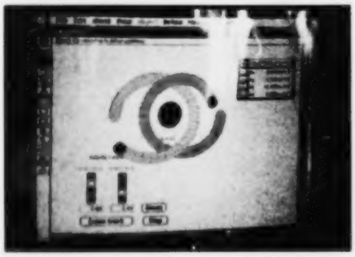
Eventually, I think, students should design their own simulations to demonstrate a concept or simulate a situation.



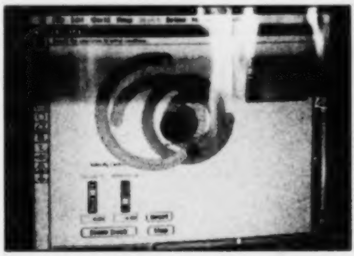
Colliding planet and moons
(no tangential, or orbital, velocity).



One student's attempt at a solution.
(Inhabitants of planets get crushed!)



Another possible solution. (Moons achieve orbit around planet.)



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After a period of time, the system becomes chaotic.

Whenever we create something ourselves, we process events much more deeply—it enhances and promotes learning. When students sit down at a computer and actually create their own programs, they learn much more than they would by just watching a computer simulation.

Again I caution. Simulations are not the real world, and they should never be used to replace actual labs in which students interact with the real world by doing an experiment. These programs should be used to enhance the understanding of concepts, particularly through visual demonstration, and to promote critical thinking.

## Technology and Philosophy

In the physics storeroom, there lay an air table not unlike the air-hockey tables at amusement arcades. It is a table with holes in the surface. Air is blown from the bottom through the holes so the pucks move above the table without much friction. Instead of demonstrating conservation of momentum, I decided to use it to demonstrate a philosophical point. Technology and philosophy? Well yes, it is possible. First I let the students play around with the table and pucks, so they're not straining at the bit to touch the pucks. Meanwhile I'm summarizing Newton's laws, including *universal gravitation.* They're not really listening, of course. The air pump is going, and they are trying to smash each other's pucks off the table. I turn the air off, friction takes over, and the pucks skid to a halt.

"Wow, friction," someone says. That's good, but I move on. I get them to summarize all the laws of the Universe that we know. Next I demonstrate a few simple collisions and show that I can predict where the pucks will end up, as in a game of pool. The laws of physics allow predictions of the outcomes of such collisions. The students then put the pucks in a triangle shape, and I smash a puck into it. Complicated motions and interactions occur.

"Suppose I had a superduper computer," I tell them. "This computer has been programmed with all the known laws of physics and is given the masses of all the pucks, their positions, and the initial velocity of the incident puck. We run a simulation of the collision on the computer. We run it for, let's say, three seconds and stop the simulation. We note where each puck is and its velocity.

"Now we actually do the collision in the real world. When we photograph the air table after three seconds, we find that the computer simulation predicted accurately where each puck would be, correct?" They usually nod thoughtfully.

"Okay, so, if this computer knows all the laws of physics and the initial condition of the pucks, it could predict where each puck would be after a day, a year, a hundred years, correct?" Mumble, mumble mixed with a few rhubarbs. The bait has been cast, and now I slowly move it to and fro. We have talked already about the Big Bang, so I take them back in time, about 20 billion years to be inexact. Matter was created moments after space-time was created, so the theory goes.

I fire up the air table, put all the pucks in the middle and explode them outward, watching them fly all over the place in apparently random motion. Letting the pucks fly for a while, I continue: "Suppose I programmed the suprcomputer with the laws of physics and fed it the attributes of every piece of matter at the moment of creation. This computer should, in principle, be able to predict the position and velocity of every piece of matter after one second, two seconds, a year, correct?" Some nod, some look uneasy with what is unfolding, some are trying to count the number of holes in the air table. Most have taken the bait, but haven't quite swallowed it yet.

In the beginning

expansion of the Universe—matter randomly moves apart as space-time unfolds

Ramona Newton Hao

15 billion years later—the particles' interactions have followed the laws of physics

"So, in principle," I continue, "the computer could predict the state of every piece of matter in the Universe after 20 billion years, correct?" Silence. I continue, "Remember the discussion we had at the beginning of the semester about what a thought is and you had agreed that it was purely the interaction of matter, like atoms, in the brain?" I pause to survey their faces. Still silence except for the student counting the holes. Some have swallowed the bait, and now I reel them in, but slowly.

This thought experiment is a good way to introduce the idea of determinism and to show how limited the idea of a mechanical Universe is. We have some great discussions on free will and such. When the students start to dismantle my logical tautology, they realize how limited the idea of a simulation of the real world by a computer is. They learn other important lessons from this demonstration. Of course, in the final analysis, the supercomputer is really unnecessary in this exercise: even if the Universe is not computable, it may still be deterministic!

## Conclusion

In conclusion, technology can be used in a variety of ways in the physics classroom; but, unless it is used wisely, students may get lost in an unreal world and may lose the social interaction in the classroom that is so important to learning. As teachers, we must avoid this danger at all costs. *We must never let technology remove us from a first-hand experience of nature through observation and experimentation.*

We are in the midst of a technological revolution that could engulf the educational world before we know what has hit us. As much respect as I have for advanced technology, I prefer to think carefully about how I can apply it in the classroom. There are many technologies I have not even touched upon here—for example, the Internet—mainly because I am still evaluating their usefulness. I don't think I'll jump on the hi-tech bandwagon but run along beside it for a while and grasp from it those pieces that will make the laws of physics easier for my students to understand.

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**Footnotes**

[1] I refer, of course, to Newton's laws of motion.

[2] Sheldrake, R. (1981). *A new science of life.* Sheldrake has proposed that learning a particular task is easier once it has already been mastered by others. This is accomplished through the morphogenetic fields each live form generates.

[3] CA-Cricket Graph III. Computer Associates.

[4] CI 6560 Signal Interface II. Pasco Scientific.

[5] Interactive Physics II. Knowledge Revolution.

# Adventures with The Geometer's Sketchpad

## Cathi Sanders

*Cathi Sanders, with a background in architecture, has taught geometry, algebra, and mechanical drawing at Punahou School for 25 years. Her approach to teaching is to combine mathematics with design and art. She has produced an award-winning, animated geometry film and several mathematical filmstrips, developed an interactive computer tutorial for* Hypercard, *and written* Perspective Drawing with The Geometer's Sketchpad.

I've been teaching geometry now for 25 years, and throughout these years I've tried many different methods of demonstrating and explaining the concepts. I spent a sabbatical studying and making math filmstrips and animated films. But filmmaking is a complicated and time-consuming process not accessible to most teachers. I've previewed and purchased many math films, and though some are excellent, they often don't emphasize exactly what I would want for a particular class, a particular topic, or in a particular way. I've used the overhead projector with sticks and rubber bands, transparencies and spirographs. I've used string and cardboard, metal contraptions and plastic models, oranges, potato chips, and soup cans. I've poured water and cut out patterns. I've sent students outside to measure shadows and to the grocery store to measure the weight of pennies. And now I use computers in addition to all these other things.

But it took me quite a while to be able to use computers. When I first started working with computers, I expected to love them. I took classes in BASIC and grappled with MS-DOS and discovered that I hated it! I thought to myself, this is not what I hoped computers would be like! But I'm a math teacher; I'm *supposed* to be good at this. I shied away from computers for a while. Then I thought again, I'm a math teacher; I'm supposed to be good at this! What's the matter with me? So I took another computer class at the University of Hawai'i where we programmed in

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machine language. It was even worse. And I just kept thinking, this is not what I hoped it would be. This is not for me.

Then in 1992, at a Hawai'i Mathematical Association workshop, I happened in on a demonstration of a new computer program called *The Geometer's Sketchpad.*[1] I watched with growing amazement as the workshop leader constructed geometric figures on the screen and then animated them before our eyes. He made altitudes slide out of a triangle as the triangle became obtuse; he transformed ellipses into parabolas; he constructed locus problems and dynamically traced out the loci by moving some of the given segments; he dragged a parallelogram, and we watched it change into a rhombus and then a square. Wow! I said to myself, this is it; this is what I expected computers to do for me! When the session was over, I did not get out of my seat; I stayed right through the next session. Then I invited the session leader and his wife to our home for dinner, and we talked long into the night about the possibilities this software opens up for education.

Thus began my love affair with *The Geometer's Sketchpad* and the computer. I use the Sketchpad in all my geometry classes now and other software with my mechanical drawing classes: drawing programs like Aldus' *SuperPaint* and computer-aided drafting programs like *MacDraft.* So how did I get from my "love at first sight" moment with *The Geometer's Sketchpad* to my current use of it in all my classes? It has been a long and interesting journey.

My first step, of course, was to learn how to get around in a Macintosh. "The Macintosh Basics Tour," which is on the hard drive of the computer when you buy it, is a great beginning for any novice. It is a delightful little hands-on interactive activity that teaches you how to point the mouse at a goldfish and make him swim, click on a drawing of a stapler and watch it jump into action, and drag a drawing of a file folder into a drawing of a file cabinet! The architects of the Macintosh created this little teaching aid with such whimsy and charm that it literally draws one into loving this machine.

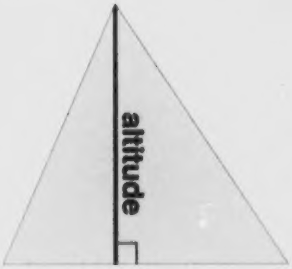
I asked questions of everyone I found in the computer lab. I asked teachers, I asked the lab supervisor, I asked students. I even, in desperation, read some of the manuals. From there, and many trials and tribulations later, I learned to draw lines, then triangles, save files and create new ones, and later, found I could help other people who were newer to it than myself! I audited a class at Kapi'olani Community College and learned a lot about *SuperPaint,* a drawing and painting program. One summer, I attended a week-long conference in Berkeley, California, put on by the publishers of Sketchpad. I met the young (21 years old!) genius who designed the program.

In the 1992-93 school year, I was granted a sabbatical to take computer classes and work on computer projects. This was my opportunity to work on Sketchpad and other programs to my heart's content, to think and plan and dream. I came back full of energy and ideas.

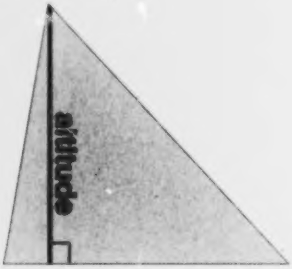
I requested a computer in my classroom, and the next year requested it again. It takes a while. But with persistence, a progressive-minded department head, and a forward-thinking administration, I finally did get my computer and began to use it with my students—my goal all along. I began with an occasional demonstration in class, having the students huddle around the tiny screen. They took to it readily. I found that they really wanted to be "hands-on" themselves, so I let them help with the demonstrations—they can click and drag as well (or better) than I can. I assigned optional extra credit projects on the computer. First a tentative few, then many students jumped right in and learned along with me. I would often tell them that I didn't know how to do a particular thing, and I'd give them extra credit if they could figure out how to do it and then teach me. They rise to these challenges. Students have few, if any, qualms about using a computer—"My friend, the computer," one girl wrote in her portfolio. I have a student now who is learning a new 3-D program that I don't have time right now to learn; he'll teach me and the class how to use it!

*The Geometer's Sketchpad* is a fascinating program. It is interesting, it can be frustrating, it gobbles up huge chunks of time, it is compelling; it has changed the way my students and I "see" geometry.

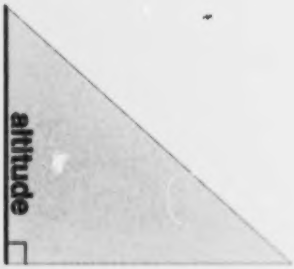
So what is *The Geometer's Sketchpad*, and how do my students use it to learn geometry? It's hard to explain on paper—by its very nature it is a visual, kinetic, interactive activity—but I'll try. A demonstration that I use very early in the course has to do with the altitude of a triangle, which is defined as "a segment from a vertex of a triangle perpendicular to the opposite side." This is a very hard concept for some students to understand, especially since there are three altitudes, one for each vertex. The students need all the help they can get. The initial Sketchpad screen looks like this:



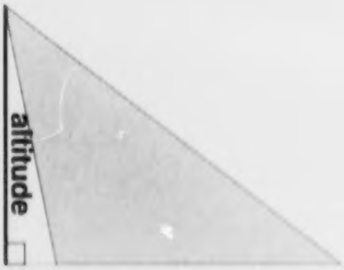
We see a triangle with one altitude. (This is in color on the computer; the sides of the triangle are blue and the altitude is red, so the altitude stands out.) Now comes the fun part. On the computer, you can sort of "grab" the vertex and "drag" this point to one side or the other. Observe what happens to the altitude. It moves:



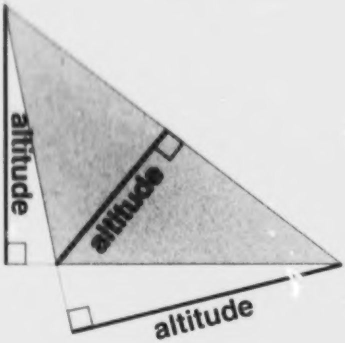
As you drag the vertex further, the triangle "becomes" a right triangle. And the students can see that the altitude "falls on the side of the triangle"; that is, it coincides with the side. (Keep in mind that this is in color, and the altitude is red.)



If we continue this process, the student sees the triangle change from an acute to a right to an obtuse triangle.



The student can watch the effect this change has on this altitude as well as on the other two altitudes.

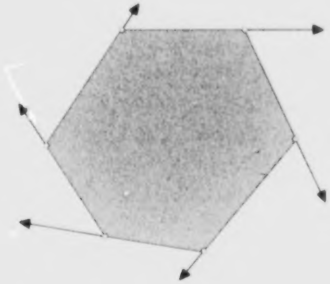


This helps a student grasp the principle: If a line is *constructed* perpendicular to another line, then it remains perpendicular to the line even when the points and segments attached to it move or change.

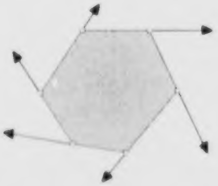
Sketchpad uses the modern equivalents of Euclid's original construction tools and is, thus, excellent for investigating and discovering the patterns and principles of geometry. With this program, teachers and students explore and experiment with geometric figures, with what "holds them together"—their definitions, the "givens" of any mathematical problem. And this exploration gets at the very nature, the essence, of problem solving: what is given and what changes; what is determined and what is not determined; what remains constant and what is variable. Students can ask, If two sides of a triangle are congruent, then what effect does this have on the angles of the triangle? If two sides are not congruent, then what is true about the angles opposite those sides? In exploring parallelism, students might wonder, If two lines are parallel, what connection does this have with the angles formed by a transversal? If you change the relationship of the original two lines, does this change the relationship of those angles? They can construct a parallelogram, then drag a vertex so that the parallelogram changes in whatever ways it can within the original constraint that both pairs of opposite sides remain parallel. Does one diagonal bisect the other? They make a conjecture: It appears that they do bisect each other. If they believe this property holds for all parallelograms, they prove it.

Why do we prove things? To verify, to document, to be sure that they are true. Sketchpad is the vehicle that we can use to experiment, to test our hypotheses, to measure, observe, and formulate the principles of geometry.

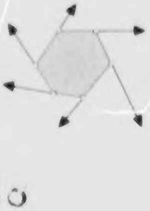
One of my favorite demonstrations on Sketchpad has to do with the sum of the exterior angles of a polygon. The students have already learned that the sum of the interior angles of a polygon is given by a formula, *(n-2)(180)*, where *n* is the number of sides of the polygon. We now need to consider the sum of the *exterior* angles of polygons. I show them a Sketchpad construction of a polygon (it happens to have five sides) with its exterior angles, one at each vertex:



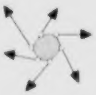
I ask them to go with me on an imaginary journey: If we were to walk away from this polygon, the polygon would appear to get smaller, it would recede into the distance. What would happen to the exterior angles? They appear to remain the same. What about their sum? The students expect a formula like the formula for the sum of the interior angles. What if we moved further away?



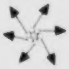
Now imagine continuing our journey through space, moving still further away from our polygon.



As we continue to move further away, the polygon gets smaller. We are still wondering what is true about the sum of the exterior angles.



As we continue to move even further away from the polygon, it becomes very, very small, and eventually it appears to be just a dot in the distance. And what can we conclude about the sum of the exterior angles of the polygon?



The sum of the exterior angles of a polygon is 360°! This is such a surprising and interesting result! We will, in class, go on to derive this result algebraically and to prove the theorem. But the visual demonstration on Sketchpad catches the students' imaginations, makes understandable a rather non-intuitive result, and is memorable.

Technology has many functions—making life easier is one of them, as typewriters and calculators do. But that shouldn't be confused with using technology for teaching. When we use technology in teaching, we should use it to help understand difficult concepts or to encourage thinking. In my geometry course, I emphasize writing, and I find the Sketchpad the perfect vehicle for posing and exploring open-ended questions. In exploring the triangle formed by joining the midpoints of a larger triangle, I ask, "What would happen if the triangle in this activity were equilateral? isosceles? scalene? What would happen if we connected the trisection points instead of the midpoints? What other possibilities are there?" And the students conjecture, they write, they explain.

I don't mean to say that I use the computer for everything in my classroom. There are some things that can be done better with three sticks than with a computer. For example, the sides of a triangle cannot be just any length: if one of the sides is very long (for instance, a long pencil) and the other two sides are very short (two toothpicks), they won't reach to form a triangle—hence the theorem: The sum of any two sides of a triangle is greater than the third side.

Technology is not an answer to every problem. It is not a replacement for the teacher, for the classroom, for cardboard models, rubber bands, sticks or clay, but it is one more tool. The computer can be a tool for demonstration, and with carefully designed activities, can be a "math lab" for discovery. The idea that excites me the most is having students use the computer as a tool with which to create their own demonstrations, activities, and projects. My students in Honors Geometry are beginning to work on their own projects on the computer: presentations and interactive activities that they themselves design on selected geometric topics. *It is when the student becomes the teacher that she learns the most.* It is in preparing an explanation for someone else that we really learn the concepts best. My vision is to have each student experience not only the excitement of discovery, but the excitement and feeling of accomplishment that comes from putting this marvelous tool to work in a way that communicates to others.

I have seen a variety of computer programs. There are those that *do things for us,* wonderful things! They calculate that which defies hand calculation; they factor equations; they draw accurate and complex diagrams. They are valuable tools to accomplish what needs to be done. And there are programs that *allow us to do things for ourselves.* They allow us to experiment, to "noodle" around, to wonder "what would happen if...," to test theories, to explore, to discover. And it is these tools of discovery that hold the most promise in education.

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As her article shows, Cathi Sanders is enthusiastic about using *The Geometer's Sketchpad* for teaching geometry. She found, however, that learning to use the program takes much time; it takes even more time to integrate it into the curriculum so that it benefits students' learning as much as possible. Wishing to make it easier to use Sketchpad for teaching, she is currently designing an "electronic" workbook to help students and teachers learn the program and to assist teachers with integrating this dynamic geometry into their curriculum.

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**Footnotes**

[1] The Geometer's Sketchpad [Computer software]. (1993). Berkeley, CA: Key Curriculum Press.

# Taking a Giant Step into Our Technological Future

## A Talk with Diana Oshiro

Gisela E. Speidel

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*This article grew out of an interview with* ***Diana Kaapana Oshiro,*** *Assistant Superintendent for the Office of Information and Telecommunication Services, Hawai'i State Department of Education. Diana supervises the voice, data, video, and information systems serving the Department. She has been a high school English and drama teacher, a Japanese language teacher, and, for seven years, she was principal of Waiau Elementary School.*

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Only a few years ago, many public schools didn't even have telephone lines going into their classrooms. That has changed. By September 1995, all schools and all classrooms will be linked to the world; they will have access to Internet. File servers will hold the accounts of the many users, direct the electronic information traffic, and download the information that students, teachers, or administrators have requested from around the world. A click of the mouse and a prompt will put them right on the superhighway.

With much of the infrastructure for the new technology in place, it is timely for Diana Oshiro, former principal of Waiau Elementary School, to take the position as head of the Office of Information and Telecommunication Services in the Department of Education (DOE). She is more interested in what teachers and students can do with computers and other new technology—in the *applications*—than in the technology itself.

Yet she does well, at least for lay people like us, at describing and explaining the infrastructure and hardware. Internet, the network linking computers around the world to each other as if they were telephones, circles the world with major intersections for states and countries to feed into it through countless on- and off-ramps. Hawai'i's connections to the Internet are mainly through the supercomputer of the Maui High Performance Computing Center and the University of Hawai'i. Diana talks fluently about LANs, Local Area Networks, which link classrooms

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and offices in a school; about WANs, Wide Area Networks, which in our state is the "Hawaiian," the network that links all the government agencies with one another; and Internet, the world-wide network. There's a gleam in Diana's eyes as she tells us, "We've already established our T-1 line between the Department of Education and the Maui High Performance Computing Center. We'll ride on their T-3 connection to the mainland and establish our own access to Internet so that all our students and DOE employees can have access."

She must have a natural bent for computers! "No, it actually wasn't one of my interests at all. I'm an English major, and I was a secondary teacher in English until I became an administrator. About three years ago, I met this technology freak. I argued a lot with him about technology. One day he asked me, 'Do you know about all this stuff?' and I said, 'No! and I don't want to know!'

"But when he showed me how to get on Internet, I started to talk—typing into my computer and using e-mail—to people in Japan, in Europe, and I met all these interesting people; I spent hours online and thought, This is great! I found the address for Howard Gardner (the developer of the current theory on multiple intelligences) and started talking with him about ideas I had for a Hawaiian language immersion curriculum for seventh grade. He became a mentor to me—an electronic one. Once I knew the power of Internet—that we could go all over the world and get all kinds of information, that it was fun, educational, and so current—I got the teachers to believe in its power.

"One vision of our department, therefore, has been to establish connectivity—among classrooms and among schools and with other states and other countries. But what do we do with all the information once we have it? How do we apply technology? How can learning be enhanced and reinforced by computers and video and other emerging technologies? Is how we teach today appropriately linked to tomorrow's technology?

"If we value diversity in thinking among our students, we must allow innovative teaching and learning processes. We need to make better and more effective use of new and emerging technologies to prepare students for a future of constant change. To accomplish these things, schools need to change. We need to develop and test new models for teaching and for running schools. These new models may force us to realize how outmoded our view of schools is—the regular school day from 8:00 A.M. to 2:10 P.M., the hourly switch in classes, the learning *within* the walls.

"We are locked into the traditional way of how teaching should be done. We must rethink what school is, think of school in a different way—we must create *virtual* schools."

What is a virtual school? "It's part of an electronic community, a community in which we communicate with others in the world electronically, in which students and teachers learn from others who may be half way around the world. The global village is becoming a reality! A virtual school is not bounded by four walls; it has no walls. Learning can happen without sitting in school all the time; technological learning tools can be taken into the community—into archives, businesses, archeological digs.

"Virtual schools, however, will require different forms of teaching. Teachers will be more facilitators—who help students gather, organize, and analyze information—than lecturers who spew forth information. There will be appropriate times for lecturing, but flexibility will be the key. Teachers will need to know when and how to teach the fundamental processes that enable students to get into projects; they will need to know how to help students during projects; and then, at the end, they will need to know how to bring students together to evaluate their accomplishments.

"Virtual schools will expand the curriculum. Basic concepts will still be taught—reading, math operations, concepts of science, and social studies—but the teaching pace will be accelerated. We should have time to teach computer programming utilizing parallel processing, we should have a different kind of journalism course that uses the new technologies, and our foreign language instruction can expand to include Internet conversations of our students using a foreign language to communicate with native speakers in other countries. Student and teacher use of video technology is another way in which the curriculum can be expanded.

"The virtual school has already begun—in the form of our teleschool, our distance learning classes that are broadcast into classrooms over cable television. For high school students, we have the daily calculus teleclass taught by Koki Tamashiro on Maui. Students, enrolled all over the state, can watch Koki, listen to him, and ask him questions. This interactive broadcast allows many students to study advanced placement calculus who would not have been able to do so because their high schools lack teachers who can teach it.

"At fifth and sixth grades we have *KidScience* with Patty Miller. Patty's science class is an example of what can happen in such teleclasses. For one of her recent broadcasts, she worked with the Maui High Performance Computing Center and local researchers on a JASON project. JASON projects provide live video broadcasts of various research activities with online communication links into classrooms so that students can ask researchers questions and participate in their research. We have so many scientists here in Hawai'i—volcanologists, astronomers, and oceanographers—who could be featured and with whom our students could talk that we thought we could do a JASON project here in Hawai'i and broadcast it with online communication to the mainland and the South Pacific. So this past March, a program called *"Island Earth,"* focusing on the volcanic forces that formed Earth and on the development of life on our planet, was filmed in Hawai'i. Four of our students were able to be a part of the expedition team. The program featured volcanic eruptions by showing the active eruption zone of Kilauea Volcano and how life forms adapt and colonize the initially lifeless craters. It also showed how astronomers are using the Mauna Kea Observatory to study neighboring planets. Not only were our students—about 300 classes from elementary through high school—able to watch the activity live, but they were also able to talk with the researchers.

"In April and May, we had a series of *KidScience* broadcasts on wayfinding. During some of the broadcasts, students were able to talk via satellite to the crews on the Polynesian voyaging canoes while they were sailing between islands in the South Pacific and Hawai'i.

"A major concern of ours is how to use technology effectively in daily teaching. My experience has been that students do very well with project learning. If they have a project to complete, they are interested and will work hard at it. Project learning has another benefit; there is usually a product—a written paper or a solution—allowing the accomplishment and its quality to be readily assessed. Because of the benefits of doing projects, we're trying to develop programs that encourage the use of new technology within projects.

"For example, we're working on a student government project that deals with international issues. We're thinking of having a student "governor" from each high school who would ask his "staff" to research, with the help of computer databases, issues—environmental, political, or other problems. Armed with the information assembled by his staff, the governor would get online to have conversations with governors from other schools to try to solve the problems at hand. We want to pilot the program first in the state to see how well the students work together and then try it nationally and internationally. International contacts would allow our students to use their foreign language in a real way, thus giving them a reason for learning a foreign language.

"Another idea we're looking at is a world news program produced and run by students. With access to Internet, our students can get information from all over the world. They can establish connections with schools in Asia, in Europe—anywhere and everywhere—to develop video news components. Maybe we can convince a Time-Warner or a CNN to buy satellite time to run the student news, since young people see news in a very different way from hardened newscasters. For students, it would be a great experience and an opportunity to do a number of authentic journalism tasks, especially for those students who are thinking of going into that field."

Partnerships with other organizations play a very important part in the virtual schools that Diana envisions. These partners can help a school financially, but perhaps more important is that they can become mentors to students and teachers. For example, programmers from the Maui High Performance Computing Center will be teaching some teachers computer programming using parallel processing. The teachers will then, in turn, teach parallel processing to interested students. Up until now, teachers have not been able to provide this computer programming instruction that the Maui partners think our students need for the twenty-first century.

"We have many projects with the Maui High Performance Computing Center. Working with their staff has been a great experience, and even though they are computer programmers, analysts, and engineers and often we don't understand each other, we are working well together on all these projects."

Diana hopes partnerships between schools and other organizations will mushroom and that a new form of mentoring will evolve—a mentoring that allows teachers and students to take a more active part than the current custom of "shadowing" permits. "Companies need to share with students and teachers some of the problems they have to solve and decisions they have to make."

But do companies want to have teachers participating in their decisions? "Large companies have community service as part of their mission. They could let teachers work side by side with their staff during the summer so that teachers learn enough about the company and its needs to give their students a company problem to work on and help them gather and analyze pertinent information for finding a solution. Teachers can share the students' solution with the company as something for the company to consider. For the company, it may occasionally be helpful to see solutions from different perspectives than their accustomed mind-set. For students, researching real problems, coming up with solutions, and justifying their solutions will be a valuable learning experience."

These new technologies need teachers who not only know how to operate the equipment but also how to use it in their teaching and their curriculum. Diana's department is doing many different things to motivate and help teachers learn about technology uses in the classroom. For example, this spring a series of 17 seminars about Internet—*Cruising the*

*Global Highway*—were broadcast over Oceanic Cable Television. A huge array of audiovisual training tapes is available for inservice training. A monthly technology newsletter, *Technology in Touch*, is published out of Diana's office. Among a number of other technological tidbits, the newsletter carries the schedule of "Teleschool" broadcasts, a column featuring new technological events in each district, and "Diana's Clipboard," a column in which teachers share what they are doing in the classroom.

Moreover, each district has a distance learning technician who works with resource teachers. The technicians are free to support their schools in using technology in whatever manner they think best, and thus these technicians have a lot of influence on what happens in schools. Since different technicians have different expertise, districts have begun to borrow each other's learning technicians.

Each district also has an Information Technology Center. "Originally, the Centers were created to train teachers and secretaries on the financial management and student information systems and different kinds of software programs, such as *ClarisWorks, Microsoft Word,* or spreadsheets. Our hope is that those centers will not only be training centers for computer uses but also video production. Actually, we already have, as a pilot, a full-blown video production studio at Kalani High School. Students and teachers from any high school can use the studio for video productions."

In spite of these training efforts, many teachers are still uncomfortable with all the new technology and are reluctant to get into it…understandably! For these, Diana tries to create a need. For instance, by asking teachers whether they wanted to have their students participate interactively with the JASON project researchers, she got many of them interested—300 teachers in all, elementary through high school. Each teacher who signed up for the project was given an Internet account at the Maui High Performance Computing Center, and they all got training in distance learning for the JASON broadcast so they would know what to do when the blinking curser came on the computer screen. They were also able to call mentor teachers for help during the broadcast. This kind of training—training linked to immediate use—makes much more sense, according to Diana. She recalls, "We used to say, 'We're going to teach about Internet. Would you like to take the course?' A lot of people would sign up and take the course. But since they didn't need to use the information right away—and often couldn't because they had no access—they didn't listen with the same sense of urgency with which the current group of teachers is listening.

"A lot of learning about how to apply the technology to teaching is happening within the schools. The schools are coming up with all kinds of *neat ideas. When our staff from the Office of Information* and Telecommunications Services goes into schools to help out, we find it hard to keep up with the school faculty: they are using CD-ROMs and videos and are making multimedia presentations. Because the answers do not lie in our office, I ask teachers to write for our newsletter and share their experiences in using technology. Also I want to create a think tank at each school, a core of teachers who are visionary types and who come up with ideas about what they would like technology to enable them to do. In this way, we hope to create the kinds of projects that will help us integrate technology into our teaching and expand and accelerate our curriculum.

Before I took this job, I knew the value of technology in education. *The technology that delivers the world into the classroom today will make the world the classroom of tomorrow.* Telecommunication makes it possible to redefine the concept of community; schools can now become part of a world community. Teachers can share information and ask for help from colleagues using the electronic network; students can become more autonomous in their studies and access resources for their projects locally, nationally, and internationally. Parents can be informed about school events through electronic bulletin boards.

"Although it is not possible to mandate the acceptance of a philosophy, once it has been presented, people start to rethink things. Gradually the philosophy is internalized by the others. The proof for this comes when people start writing about what they are doing, and what they are doing reflects the philosophy. Until now we have used all our energy to learn to walk in technology and have taken small steps. It is time to take a giant step into our technological future."

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Diana Oshiro wishes our readers to know that she welcomes public and private schools to contact her office for any assistance in classroom technology use.

# MIDAS Has the Golden Touch!

## Irene Yamashita

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***Irene Yamashita,** on loan from the Department of Education, is Resource Teacher for the MIDAS (Multimedia Industry for the Development of Academic Software) project. Starting out five years ago with no media production skills, she has learned so much about this technology that her work has won her school, Kapunahala Elementary School, state and national awards for outstanding video production with children. Her secret: She believes there is a spark of magic inside everyone.*

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"When Pearl Harbor was attacked, we quickly buried our family sword and Japanese artifacts so that the FBI wouldn't think we had ties to Japan." These words, spoken by Elaine Yamashita, were captured on video during an interview with her eight-year-old grandson, Christopher. The interview is one of the stories created with *Our Story Caravan,* an interactive CD-ROM developed by Rising Wave Incorporated. This program makes learning meaningful and relevant for students as they become historians and storytellers of their own personal experiences.

"Generations," the first module, focuses on children's self-awareness, families, and communities through time. Students have opportunities to share their own history by creating a multimedia presentation with *Our Story Caravan's* shell. Peer sharing fosters "intersubjectivity"; that is, it helps students reach a level of mutual understanding and shared definitions.

When Christopher shared the interview of his grandmother with his classmates in third grade, they became so fascinated with the events of World War II that they took the activity beyond the classroom. They began interviewing their parents and grandparents about their experiences during that period of history. Many discovered their roots in Hawai'i's sugar plantations. They, too, could import their oral history into *Our Story Caravan.*

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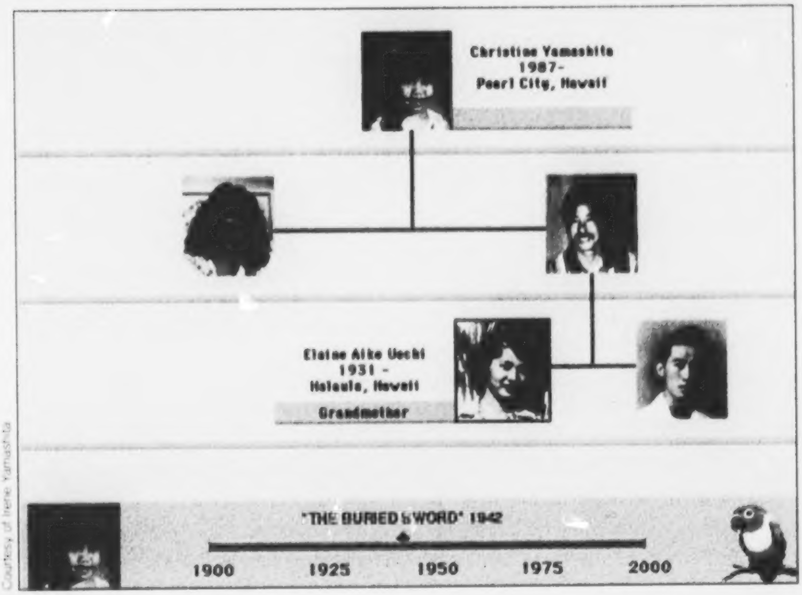


Christine Yamashita
1987-
Pearl City, Hawaii

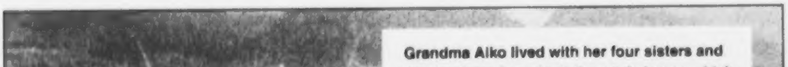
Elaine Aiko Uechi
1931 -
Halaula, Hawaii

Grandmother

"THE BURIED SWORD" 1942

1900
1925
1950
1975
2000

Courtesy of Irene Yamashita



Grandma Aiko lived with her four sisters and two brothers in a plantation style home, which had an outdoor bath (furo) and an outhouse.

"THE BURIED SWORD" 1942

1900
1925
1950
1975
2000

Courtesy of Irene Yamashita

BEST COPY AVAILABLE

The program provides a thematic curriculum for grades K through 12 that teachers can adapt to their lesson plans. It begins with the concept of self-awareness and progresses, in a series of modules, to more global perspectives for upper grades. Students spend 90 percent of their time researching and collecting data such as photos, documents, letters, and other primary and secondary sources of information; in the remaining time, they create their multimedia presentation. To import the data they have collected into the shell provided by *Our Story Caravan,* students use the scanner, digital camera, video camera, and software applications. The CD-ROM, which has been formatted for both Macintosh and Windows-based computers, is required for running the interactive program, but students' work can be stored on the computer hard drive.

Ultimately, students will be able to share their stories over Internet with students around the world. The learning opportunities afforded by this approach promote critical thinking, problem solving, and technical knowledge and skills—skills aligned with the National Education Goals 2000: "By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsiblities of citizenship."

The history of *Sea Search: Exploring Tropical Marine Life* makes one appreciate CD-ROM technology. The developer, Moanalua Gardens Foundation, had created a slide bank of Hawaiian terrestrial life and provided this slide bank to the Hawai‘i Department of Education and to public libraries. A similar slide bank on Hawaiian marine life was considered, but this time the images were to be stored on CD-ROM since this medium would be less expensive and easier to distribute. With CD-ROM technology, however, the program became much more than just a slide bank.

The database features over 300 images of Hawai‘i marine organisms and information about their taxonomy, habitat, diet, special adaptations, hazards of encounter, and Hawaiian legends and uses. Students can navigate paths for problem solving, interact with simulations, access video and sound files, create a slide presentation from the images in the program, gather information from the extensive database, and take notes in an electronic notebook.

"Reef Rap," an appealing animation set to original music, captures the young-at-heart of all ages. The catchy lyrics, collaboratively written by Roosevelt High School science teacher Pauline Chinn and her friends, describe the unique characteristics of sea creatures such as the *humuhumu-nukunuku-ā-pua‘a.*

Courtesy of Moanalua Gardens Foundation

The program provides access to the database through Reef Rap, the Guide, or the Tool Box by just clicking on images that prompt the appearance of another screen, such as a picture of the butterflyfish family. Clicking on the image of a specific organism leads to the database of that organism with video clips, scientist remarks, pronunciation of its scientific and Hawaiian names, and vocalizations. Quick-Time video clips show a scorpion fish capturing its prey, the graceful movement of jellyfish underwater, a glimpse of endangered Hawaiian birds, and a Hawaiian sea turtle laying eggs. Vocalizations include those recorded from the humpback whale, the Hawaiian monk seal, and the sooty tern. Dr. Lou Herman of the Kewalo Marine Mammal Laboratory and Dr. Jack Randall of the Bishop Museum are among the scientists who share their background of how they got started in marine biology and the experiences and insights gained during their careers.

"The Mystery of the Devastated Diners" is an interactive module of the program that presents students with a scenario in which ten diners become ill after eating some fish. The students are to investigate the cause of food poisoning by interviewing the cast of characters—the doctor, the cook, a fisherman, and so forth. The questions students can ask in their interviews are based on the WRAITEC critical-thinking model developed by Dr. Thomas Jackson, professor of philosophy at the University of Hawai'i. Information gleaned from the interviews—as well as from the main database of *Sea Search*—can be recorded in an electronic notebook. Upon successfully passing the program's test on determining the cause of food poisoning, students advance to the next level, which has a simulation for collecting and testing water samples to confirm their analysis of what happened to "the devastated diners."

Students who used *Sea Search* commented that the most enjoyable feature was the ability to create their own slide show with the program. They could select images from the database and type their own text for

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their presentations. A free copy of *Sea Search* will soon be available to every school in the Department of Education.

*Blue Venture*, being developed by Mānoa Interactive Productions and Arnowitz Studios, is a multimedia supplementary science curricululm for intermediate and high school students. This interactive CD-ROM and videodisc program examines ecosystems; biospheres; human population; water, air, and land management; atmosphere and climate; food production; and energy consumption and conservation. Students can explore scenes such as coastal zones, wetlands, mangrove swamps, coral reefs, or the Hawaiian Islands' unique ecosystem. Offering a wide variety of environmental educational topics, this program includes both national and global concerns. It provides students with opportunities to create their own models for addressing key environmental issues; they can interact with the program and investigate their hypotheses by controling scientific and economic data and evaluating the impact of their manipulations.

These three multimedia CD-ROM products are being developed here in Hawai'i and are projects of MIDAS[1] or the Multimedia Industry for the Development of Academic Software. MIDAS was established in 1993 to promote technology in the classroom and to stimulate and broaden Hawai'i's multimedia industry. Funding comes from both the State Legislature and from the private sector. Selection of the MIDAS projects was based on whether they encourage the simple use of multimedia tools by teachers and students, support a thematic approach to teaching, and cover concepts in the Department of Education's Essential Content Standards.

With the growing emphasis on technology in schools, we need to keep in mind that the curriculum should drive the technology. We need to decide how and what technology is appropriate for our classroom and for our own comfort zone. To teachers who view technology as an overwhelming, time-consuming monster, I say yes, you're absolutely right. But this monster isn't so bad if you see yourself learning along with your students and if you set specific, manageable goals. My goal this year was to learn how to use a scanner for digitizing images. I not only learned to scan but to import the digitized images into programs such as *Hyperstudio* and *Adobe Photoshop.* I feel so empowered that I now look forward to having my students learn these new skills.

As a resource teacher for MIDAS, I have been able to witness the tremendous opportunity technology provides for higher thinking and problem solving. CD-ROM programs encourage students to take responsibility for their learning while letting them learn at their own pace. It has been exciting to see computers motivate and capture the interests of high-risk students, to see timers set so that everyone gets a turn at the computer, to hear students ask each other questions about how they created a slide show, to watch teachers learn the technology alongside their students and become excited when technology challenged their students to learn and make connections.

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**Footnotes**

[1] MIDAS is managed by the Hawai'i Software Service Center, a program of the State of Hawai'i High Technology Development Corporation. Funding for MIDAS came from the State Legislature, in the amount of $450,000, and from matched private funds.

# Who's in the Driver's Seat?

## Robert G. Peters

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**Robert G. Peters,** *Headmaster at Hanahauoli School, has a serious interest in identifying the relationship between theory and practice, particularly the philosophy underlying curricular decisions. He currently teaches a graduate course at the University of Hawai'i-Mānoa on curriculum and the elementary school child and serves on the Board of Directors of the Hawai'i Association of Independent Schools.*

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Every time I hear or read about the information superhighway, I cringe a bit, knowing how limited my current skills and understanding are. The thought of what lies ahead technologically is daunting. The attractions of getting on the highway should concern many of us in decision-making positions, but where do we go to get "serviced" to give reality (actual, and not virtual) to the dreams, wishes, and expectations of our constituencies?

At a recent meeting of independent school administrators, the topic of technology surfaced. Many of us nodded in agreement as one participant described the process of implementing a technology program "as being sucked into a black hole." Having others share my feeling at least gave me some momentary comfort; but, it once again highlighted the insecurity that accompanies making decisions in a marketplace that changes so rapidly. How does one prudently approach designing and implementing an appropriate technology program for a school? What questions need to be asked to guide decisions? Who should be involved? And, how does the head of school make decisions that encourage moving ahead while insuring that funds are well spent and equipment purchased is consistent with the school's teaching practices and philosophy?

It is the role of the head to provide direction and leadership for realizing the school's vision; this includes technology. Let me share with you the story of how one school has attempted to locate the place of technology in its program and how its headmaster may have facilitated and, at times, slowed the progress.

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Like many schools, Hanahauoli became involved with computer education in the mid-1980s. We placed our first few Apples in our math lab, because the math lab teacher had spearheaded the computer committee, taken courses, and was eager to see what our youngsters could do. We had all read Seymour Papert and many of us had tried LOGO courses. All children in grades 1 through 6 had an opportunity to be introduced to LOGO activities, and we were convinced at the time that learning to program was the way to go.

Dissatisfied with the limited time children had on the computers in the lab, we decided to purchase more for the classrooms. Each classroom had at least one and some shared additional computers in movable carrels. Classroom use varied according to teacher enthusiasm and comfort with the new technology. Some lacked adequate experience and in-service opportunities to feel in control as teachers; others questioned whether the computer time took away from important academic instruction.

Our teachers of young children questioned the appropriateness of computers for early childhood. They experimented with ways to instruct, often relying on kinesthetic modes for helping children—and perhaps teachers, too—grapple with what seemed the "magic" in the monitor. The turtle on the screen came to life as children simulated its action on large grids set up on the floor or moved a stuffed creature along the maze. It quickly became clear that directionality was as important for computer learning as it was for reading. While older children seemed to become fairly proficient at creating the LOGO designs and applying problem-solving techniques, younger children were encouraged to experiment with the computer and learned to move the turtle in various directions to achieve simple designs.

Progress was visible; but many adults remained mistrustful of the new equipment and worried that children might become antisocial and that the role of the teacher would be diminished if this computer craze really caught on.

Teacher turnover found us with new faces that had not participated in the earlier computer planning. These teachers were not part of the culture that had studied together and planned the direction the program would take. LOGO still existed in some classrooms, but the early enthusiasm was clearly waning. Word processing seemed to have become the primary use of the computer as an adjunct to classroom writing or for special projects. The latter part of the 1980s found our school without technological leadership. No teacher, and certainly not the headmaster, had come forward to give new life to the program or to give us a reason to go back to the drawing board to review and revise our original plan.

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*The purchase of hardware and software does not a technology program make.*

While the school's technology program seemed at a standstill, the world outside was pushing ahead with alarming speed. Children were increasingly familiar with computer games and the new software programs. Drill-and-practice programs were purchased by parents, and simulation exercises were touted as tools to promote thinking skills unlike anything currently happening in the classroom. More was being published about the "information age" and the need for schools to recognize its implications for program, curriculum, and the type of graduate desired.

The increasing pressure from the outside encouraged us to hire a part-time computer teacher who would work with all children in a computer lab. Keyboarding along with learning to use many of the simulation games and some of the drawing programs gave children exposure to computer technology, some of which could be applied in the classroom. The computer teacher was knowledgeable and able to keep the program afloat while we continued to search for the place of technology in our program.

By this time, all classrooms were using word processing, some were using curriculum-related simulations, and some were exploring the application of multimedia. Teachers were at different levels of comfort with the technology: some were beginning to identify possibilities, while others saw it intruding upon their teaching. And some, like their headmaster, felt only semi-literate technologically and uncomfortable—as well as unsure—about ever moving beyond that point. Many of us realized that taking courses and attending workshops did not guarantee computer use; in fact, without continued application of what was learned in such workshops, it was much easier to ask someone to do the task for you or to problem solve in your stead.

Despite the many misgivings, it was time to move ahead and determine a direction for our program. Self-selected, motivated faculty formed a new technology committee to assess our current state and to offer a redefined curricular plan. We needed new computers and our software was limiting; but I feared we could easily get stuck in the equipment issue and not see it in relationship to a clear vision for the future. As the headmaster, I insisted that the group design a vision for the school's technology program and begin to elaborate that vision in terms of its implications for the school's overall program. The group struggled with the vision and with defining a place for technology in our curriculum. Everyone realized that our children were not getting enough experience with technology and that many were exposed to much more in their homes and outside of school. But, just how to change that situation was perplexing:

- Should we maintain a lab with a specialized teacher for all children?
- Would children benefit more from having the technology available in their own classrooms?
- Would teachers use the equipment more if it resided in the classroom?
- How would teachers learn to use the equipment and teach their children?
- Is technology a discipline unto itself, requiring specialized instruction?
- How does technology relate to our beliefs, our philosophy?

We also had more practical queries:

- Where will the funding come from to support the program?
- Should we have two platforms (IBM and Macintosh) or one?
- Who will be in charge, and how will technical expertise be provided?
- Do we need a Local Area Network?

Trying to answer these questions provided some tense moments as those (teachers, parents, administrators) who were well-versed in computers and technology argued strongly their points of view while others were urging caution. Outside advisors added confusion, particularly computer company representatives as they promoted their products. I found myself listening intently, trying to sort out the information, and often feeling overwhelmed and incredibly pressured, particularly by those who wanted us to "jump in with both feet" before the world passed us by.

Some questions were beginning to have answers. The start-up funding had been raised in a successful anniversary event at the school. The faculty committee had clarified its notion of the vision for technology, supported by a clear rationale which recognized the role of technology as a tool for learning. Curriculum strands to guide our computer instruction were identified along with a clear sense of the many ethical issues to be faced. The strands included *literacy* (knowing how and when to use the equipment and acquiring a sense of its future potential), *applications* (viewing equipment as a means to access, process, and express information), *values* (recognizing legal and ethical implications of technology and its responsible use), and *design* (experimenting with new ideas).

While teachers were modifying the draft of their plan and setting new goals for the committee, I attended a national conference which featured new technologies as an integrative force in the classroom. This experience, I thought, would give me a sense of how to incorporate technology in the curriculum and the background to provide the necessary leadership.

I listened intently, again. I tried out equipment and software, again. I talked with presenters about integration, again. I visited more vendors than I could count, again. And again, I flew home feeling that computers and related technologies were basically driving the curriculum. It was always the program and not the user in "the driver's seat."

By this time, we had organized a group of interested parents to assist us with our technology planning. They were an eager and well-informed group. Many were skillfully using technology in their own businesses and had experimented with many programs in their homes. Learning to use their expertise and investment, while keeping the total school picture in view, proved to be a delicate task; but, their service proved to be invaluable. Some explored the cost differentials between purchase and lease arrangements; some investigated software and professional development opportunities; some gathered data on the two platforms under consideration; and some helped us to dream about what was possible. Of great benefit was the group's parent survey which helped us to see that most parents viewed technology as we had, that many were struggling with issues at home similar to those at school. Some were concerned about over-involvement with technology to the exclusion of other important things, and most realized the world was demanding a careful look at the place of technology in our children's lives. A three-year purchase plan emerged from these meetings; we began phase one this past semester.

When school resumed in the fall, it certainly seemed that we were finally under way. Yet, uneasiness was still lurking in my mind. I still did not feel adequately informed and able to provide the kind of leadership needed and sought. Adding to my uneasiness was the invitation to become a part of Internet, which seems an incredible resource for teachers and for secondary and college students. Its application at the elementary level, however, remains a bit elusive to me except as a means for long-distance learning and perhaps shared projects. I cannot help but wonder what happens to those youngsters who have difficulty finding a word in the dictionary or a topic in a reference source once they are on the Internet. Will they find their way back?

It also takes time to get new computers and programs operational; with each addition, there seems to be something forgotten that is absolutely essential. We expected to install the new equipment and enter the "highway." But this just doesn't happen, given the nature of the machinery and the time it takes to instruct both children and adults. Some have suggested that we just allow children to explore as we would with most other materials. And yet, when we do, problems arise that they cannot resolve or that reside in the equipment from misuse. We need a troubleshooter who can guide us in the technical setup and who has the time and expertise to assist with problems.

Schools can easily be lured into the world of technology without considering the impact upon their program and curriculum. What has become startlingly clear to me through these years of searching is the need for a plan that identifies what children should be learning and the type of teacher, administrator, and education needed to make that learning happen. (Spontaneity has a place, but I don't think it is in the design stages of a technology program.) The purchase of hardware and software does not a technology program make. A framework that includes goals for children and teachers is essential if technology is to become a tool of the classroom rather than a determiner of what is studied and learned. Professional development is a key ingredient and needs to include those in leadership positions. This element is essential if schools are to have appropriate leadership and programs consistent with their beliefs and philosophies. Planning, therefore, should include opportunities for administrators to learn alongside faculty and students.

This idea was reinforced through a recent experience. Our technology plan includes opportunities for the headmaster, as well as the faculty and children, to become informed about technology. Thus, in a recent workshop focusing on using technology to enhance curriculum, I was able to explore its possibilities together with teachers of our school. The workshop taught us how to create multimedia products and how to use this technology to support children's learning and to demonstrate what they have learned. I had the opportunity to work on a team and explore the multimedia equipment. Problem solving with my partner brought home the collaborative potential of technology along with the complex thinking and application skills required to make technology a part of the curriculum rather than its driver. I also became familiar with the software and hardware available for integrating technology into the curriculum, thereby assisting our future decision making.

*Administrators should learn alongside faculty and students.*

This hands-on workshop helped to bridge the gap between my knowledge of curriculum and children's learning and the technology. It gave me the confidence and direct experience to now feel comfortable "in the driver's seat," albeit always remembering to buckle up as we merge onto the highway.

# A Few Bytes of Technological Advice

## Curtis Ho

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*Curtis Ho, Director of the Center for Instructional Support and Associate Professor of Educational Technology at the University of Hawai'i-Mānoa, has conducted research in distance education and interactive multimedia. He teaches a wide variety of graduate and undergraduate technology courses, including educational media research, interactive multimedia, telecommunications, video technology, and computer-based education.*

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The business of teaching and learning is becoming increasingly complex and expensive. Educators are challenged to create a learning environment that is as technologically sophisticated as our high-speed, digital world. Over the past decade, schools have spent an enormous amount of time and money to develop technology plans and have been aggressively investing thousands of dollars in computer hardware and software. Parents and the community have donated their time and money to raise the level of technology in schools.

Business for hardware and software companies has been astounding. Has it been good business for schools as well? Have they made a wise investment in technology?

Reports about the wonderful educational benefits of the new computer-based technologies abound. Several years ago, a researcher claimed two decades of research showed that computer-based instruction improved learning by 30 percent in 40 percent less time and at 30 percent less cost compared with traditional instruction. Other researchers have reported that computers improve critical thinking skills and self-esteem.

One should be cautious about broad generalizations such as the two above. The essential question to ask is who is reporting the finding in what kind of journal. Many claims are made by researchers employed by technology companies with a financial stake in the results. Furthermore,

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many technology journals are consumer oriented and rely on advertising income from companies whose products are being evaluated. In fact, many published reports are not research based but opinion based. Actual research results are most often based on a specific group of participants studied under specific conditions; findings from one study cannot be automatically applied to other groups under other circumstances. Findings generalized from one study to another group must, therefore, be treated cautiously.

How can we determine whether reports about a piece of software, a particular use, and so on is actually true and based on sound research? Where can we go to find effective applications? Large government-sponsored studies provide perhaps the best source of comprehensive research information. For example, a recent congressional report by the Office of Technology Assessment (OTA)[1] found that while instructional technologies are considered essential teaching tools, limited support is given to help teachers apply them in the classroom. Lack of time for teachers to attend training sessions, to experiment with hardware and software, or to exchange ideas with other teachers is viewed as the greatest barrier to effective technology use. In essence, the report supports the belief held by many that technology has the potential to help teachers but by itself cannot improve teaching and learning. And, it may be a waste of energy to compare the benefits of one technology over another.

There are other reliable publications reporting clearly defined applications of technology. Most curriculum journals provide quality information on using technology for teaching and learning. Many practitioners share their experiences in these journals. To help those newly arrived on the technology scene navigate the infinite sea of technology publications, I have listed professional journals, technology organizations, and quality software and multimedia catalogs in the following three tables.

**TABLE 1**

PROFESSIONAL TECHNOLOGY JOURNALS

- Classroom Computer Learning
- Computers in the Schools
- The Computing Teacher
- Educational Technology
- Electronic Learning
- International Journal of Instructional Media
- Journal of Computer Assisted Learning
- Journal of Computer-Based Instruction
- Journal of Computers in Mathematics and Science Teaching
- Journal of Computing in Childhood Education
- Journal of Computing in Teacher Education
- Journal of Educational Computing Research
- Journal of Educational Multimedia and Hypermedia
- Journal of Special Education Technology
- Journal of Technology and Teacher Education
- Media and Methods
- Teaching and Learning

## TABLE 2
### TECHNOLOGY ORGANIZATIONS

These organizations offer valuable information on instructional technology through conferences, seminars, workshops, journals, newsletters, and electronic discussion groups. Members often provide the best expertise in the applications of technology to teaching and learning.

Association for the Advancement of Computing in Education, P.O. Box 2966, Charlottesville, VA 22902

Association for Educational Communication and Technology, 1126 16th Street, N.W., Washington, DC 20036

Association of Supervision and Curriculum Development, 1250 N. Pitt Street, Alexandria, VA 22314-1403

Institute for the Transfer of Technology to Education, National School Boards Association, 1680 Duke Street, Alexandria, VA 22314

International Society for Technology in Education, University of Oregon, 1787 Agate Street, Eugene, OR 97403-9905

Minnesota Educational Computing Corporation (MECC), 3490 Lexington Avenue North, St. Paul, MN 55126

Society for Applied Learning Technology, 50 Culpepper Street, Warrenton, VA 22186

## TABLE 3
### GENERAL SOFTWARE AND MULTIMEDIA CATALOGS

Educational Software Preview Guide for 1993-94, International Society for Technology in Education, 1993. Contact: Anita Best, Consortium Chair, (503) 346-2400

IBM EduQuest Catalog. Available from: EduQuest, 411 Eagleview Blvd., Exton, PA 19341, (800) 769-8322

Intellimation K-12 Macintosh Software and Multimedia Catalog. Available from:Intellimation, Dept. 2KF, 130 Cremona Drive, P. O. Box 1530, Santa Barbara, CA 93116, (800) 346-8355

Laser Learning Technologies Catalog. Available from: Laser Learning Technologies Inc., 120 Lakeside Avenue, Suite 240, Seattle, WA 98122-6552, (800) 722-3505

Multimedia and Videodisc Compendium. Available from: Emerging, Technology Consultants, Inc., 2819 Hamline Avenue N., St. Paul, MN 55113, (612) 639-6973

National Geographic Ed-Tech Catalog. Available from: National Geographic Society, Educational Services, P. O. Box 98018, Washington, DC 20090-8018, (800) 368-2728

Only the Best: Annual Guide to Highest Rated Education, Software/Multimedia for Preschool-Grade 12, published by Association for Supervision and Curriculum Development, 1250 North Pitt Street, Alexandria, VA 22314

Videodiscovery Educational Videodisc Catalog. Available from: Videodiscovery, Inc., 1700 Westlake Avenue, N., Suite 600, Seattle, WA 98109-3012, (800) 548-3472

Ztek Co. Educational Multimedia Catalog. Available from: Ztek Co., P. O. Box 1055, Louisville, KY 40201-1055, (800) 247-1603

We do know that when integrated appropriately into the curriculum, technology can support the achievement of specific learning outcomes. There are several ways in which technology has been effective.

- facilitating student-centered learning
- allowing students to choose learning path and pace
- accommodating several learning styles and modalities
- promoting cooperative learning and student collaboration
- facilitating interdisciplinary learning

But even if carefully conducted research has shown a piece of software or technology to be effective in the classroom, it still may not be right for your teaching style or your kind of students. Good use of technology is a very personal thing. I list a few strategies that you can use to evaluate whether technology can work for you.

- Develop a vision for teaching your class in an ideal environment. Concentrate on student outcomes rather than technology. What do you want them to be able to do with what they learn in your class? Does it involve critical thinking, problem solving, communication, and collaboration?
- Find out who has been successful in integrating technology in your curriculum area. How do their outcomes match those specified in your vision? (Professional journals and conferences would be a good resource.)
- Determine which teaching strategies in your vision can already be supported technologically by your school and which ones require new technologies. This means taking a look at your school technology plan and the technology infrastructure and then making a list of further technologies needed to make your vision work.
- Make a list of skills that you and your students will need to have to operate the technology and see whether your school will be able to provide the necessary training.
- Design an evaluation plan to measure each implementation. Be sure to include student feedback in your plan. Revise your teaching strategies as needed.
- Determine whether you have achieved the goals of your vision. Determine how technology has made a difference in teaching and learning. Share your results with others. Look at how you might expand or integrate your curriculum with other disciplines or teachers.

A congressional report by the Office of Technology Assessment has this to say about technology in education:[2]

> Technologies offer teachers the ability to do many traditional teaching tasks efficiently and quickly, and they can support entirely new teaching and learning opportunities that may be critical to the next generation of learners. Many teachers find that technology can help them improve student learning and motivation, address students with different learning styles or special needs, expose students to a wider world of information and experts, and encourage student initiative and collaboration.

While technology is not a cure for all of the problems with education, it provides schools with an opportunity to engage in innovative ways of teaching and learning as well as prepare students with technology skills that will be needed in the workforce.

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**Footnotes**

[1] U.S. Office of Technology Assessment. (1995). Teachers and technology: Making the connection (No. 052-003-01409-2). Washington, DC: U.S. Congress. For copies of the 304-page report, call(202)512-0132, Superintendent of Documents. An 8-page copy may be obtained at no cost by calling (202)224-8996.

[2] *Ibid.*

# Information Literacy: A Challenge for Critical Thinking

## Elaine Blitman

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***Elaine Blitman** is the Director of Instructional Services at Punahou School, where she has worked for the past 28 years. Preparations for students and teachers to use the new Internet connection at Punahou have raised many thought-provoking issues, among them challenging opportunities for critical thinking.*

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A weekday edition of the *New York Times* today contains more printed information than the average seventeenth-century Englishman was likely to see in a lifetime.[1] Current estimates are that information now doubles every three years.

Access to immense amounts of information presents a challenge to teachers and students as they contemplate the resources available through Internet, television, CD-ROM, microfiche, computer software, books, magazines, and newspapers. Using these resources well is both a delight and a dilemma. As John Naisbitt said, "We have for the first time an economy based on a key resource that is not only renewable, but self-generating. Running out of it is not a problem, but drowning in it is."[2]

Until recently, our students have done their information gathering in libraries. Library collections are usually selected by professionals to meet the needs of a particular clientele—the selection process includes the assurance that the materials are authentic, well-balanced, and suited to the age group(s) using the facility.

One of the recent sources for information, the Internet, with its ever-expanding deluge of information, is like a firehose compared to the soda straw of more traditional knowledge sources. Anyone can publish on the Internet, and there may not be a way to identify and confirm the sources

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or authenticity of the material. Clifford Stoll, author of *Silicon Snake Oil: Second Thoughts on the Information Highway,* said in a recent interview for *The New York Times:* "What's missing is anyone who will say, hey, this is no good. Editors serve as barometers of quality, and most of an editor's time is spent saying no."[3]

However, there are also unparalleled opportunities for collecting information from primary sources—such as the recent Hawaiian canoe voyages, for communicating directly with experts in many fields, and for comparing data from students in other locations around the world. Moreover, huge collections of quality information can now be easily accessed, such as the Library of Congress, which is sharing such sources as holographic images of drafts of the Gettysburg Address on the World Wide Web.

How can teachers deal with this deluge of information available to them and to their students? How can they have their students develop strategies to deal with this overwhelming situation? How can they help students organize and use the massive sources of information and prevent them from drowning in it? In short, how can teachers turn their students into information literate young people? Teachers are not alone in this struggle. Many educational organizations are searching for ways to deal with the information overload dilemma.

## What is Information Literacy?

A definition of what is meant by being information literate is a good starting point. The American Library Association's Presidential Committee on Information Literacy gives us this definition:[4]

> Ultimately, information literate people are those who have learned how to learn. They know how to learn because they know how knowledge is organized, how to find information, and how to use information in such a way that others can learn from them. They are people prepared for lifelong learning, because they can always find the information needed for any task or decision at hand.

Christina Doyle, Associate Director for the California Technology Project and Director of the Telemation Project, describes the attributes of an information literate person as follows:[5]

- recognizes that accurate and complete information is the basis for intelligent decision-making
- recognizes the need for information
- formulates questions based on information needs
- identifies potential sources of information

- develops successful search strategies
- accesses sources of information including computer-based and other technologies
- evaluates information
- organizes information for practical application
- integrates new information into an existing body of knowledge
- uses information in critical thinking and problem solving

The concern for educating an information literate youth is spreading. Take for example the creation of the National Forum of Information Literacy. It was established in 1989 as an umbrella group for 60 organizations with members from business, government, and education, all sharing an interest in information literacy.

To be prepared to take part in an information-based society and technological workplace, students need to have the skills described above. The Association of Supervision and Curriculum Development (ASCD), one of the members of the National Forum on Information Literacy, adopted in 1991 the following:[6]

> Information literacy…equips individuals to take advantage of the opportunities inherent in the global information society. Information literacy should be a part of every student's educational experience. ASCD urges schools, colleges and universities to integrate information literacy programs into learning programs for all students.

Librarians, who have been the guardians of our institutions for collections of information, are also thinking about educational requirements for the information age. The American Association of School Librarians published a paper on the basic elements of an information literacy curriculum:[7]

- define the need for information—ask the right questions
- determine a search strategy
- locate the needed resources
- access and understand the information found
- interpret the information
- communicate the information
- evaluate the conclusions in comparison with the original problem

The paper also points out the important role of school media centers and library media specialists in educating children and includes several examples to illustrate this concept.[8] Two examples are included here:

> In the middle school media center students are using electronic mail to work with scientists and other students on the International Arctic project. Using the Internet, students are sharing data from their own lake study project with students as far away as Russia. They are also following an Arctic training expedition, questioning and receiving information from the explorers.
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> Advanced high school students involved in an independent study in chemistry are matched with mentors with whom they communicate through telephone and Internet. The mentors guide students in project expectations and completion time.

## Becoming Information Literate

The development of point-and-click software and graphic interfaces is making an immense difference in the accessibility of material on the Internet, CD-ROM, and other multimedia sources. Searching through vast resources is becoming easier with the development of online graphic browsers such as *Netscape* and *Mosaic*. Students who can locate and see portions of the collections in the Smithsonian Museum, the Louvre, the Franklin Museum of Science, find the NASA *Update on Current Volcanic Activity*, or use the *Children's Literature Web Guide*, to list just a few resources, have the ability to explore where their interests lead them and to gain new knowledge and skills.

One of the most challenging skills is information analysis. Software is now being published that helps with this task. One example is *Data Collector*,[9] a tool enabling students to organize and analyze qualitative data obtained from interviews, observations, surveys, journals, and other documents in order to look for patterns and to identify themes. The "Note Collector" section facilitates note-taking for literature reviews and contains a keyword function, allowing the collection of notes around a topic area across citations and entries—in a sense, replacing the former searches through file cards.

Other difficult tasks are determining the credibility of a source, recognizing stereotypes, and distinguishing facts from value judgments. One tool to help students develop these abilities is the CD-ROM *Powers of Persuasion*,[10] based on a compilation of World War II propaganda. The CD can also be used to study propaganda, bias, and point of view.

These are only a few examples of new tools, published recently, to help with the task of educating youngsters—and their teachers—for the challenges they face with the information feast.

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**Footnotes**

[1] Wurman, M. (1989). *Information anxiety.* NJ: Doubleday.

[2] Naisbitt, J. (1986). *Megatrends.* Warner Books.

[3] A disillusioned devotee says the Internet is wearing no clothes. (1995, April 4). *The New York Times.*

[4] American Association of School Librarians. (1993). *Information literacy: A position paper on information problem solving.*

[5] Doyle, C. S. (1994). *Information literacy in an information society: A concept for the information age.* ERIC Clearinghouse on Information and Technology.

[6] *Ibid.*

[7] American Association of School Librarians, *op. cit.*, see footnote 4.

[8] *Ibid.*, p. 4

[9] Data collector [Computer software]. (1995). Intellimation Library for the Macintosh.

[10] Powers of persuasion [CD-ROM]. (1995). Intellimation Library for the Macintosh.

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# How Does Technology Affect Society?

**Gail Tamaribuchi**
**Ramona Newton Hao**

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***Gail Tamaribuchi,*** *Director of the Center for Economic Education at the University of Hawai'i, joined the Curriculum and Instruction Department of the College of Education after many years as a secondary school teacher. She has authored state curriculum guides, instructional materials, and high school economics texts.*

***Ramona Newton Hao,*** *currently Associate Editor and photographer for this journal, has also been a teacher and educational consultant during her 22 years with Kamehameha Schools.*

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The articles in this issue have described technology in education from two perspectives: using technology to enhance teaching and learning, and teaching students how to use technology. When we consider technology as a teaching and learning tool, we think of video equipment to show, for example, animals in their native habitat, a re-creation of a Civil War battle, or *A Midsummer Night's Dream* to accompany Shakespeare's story. We think of the computer as a word-processing tool for students to write or, when attached to a modem, as a means to communicate with other students and other classrooms and to search databases for information. We think of overhead projectors to throw images on the wall so all can see as teachers demonstrate how to revise a sentence or multiply fractions.

We also see schools as a place for students to learn to use technology, particularly the technology associated with computers. We teach them how to use computers and give them assignments, in different subject areas, that require computers. We prepare them with the skills needed not only for jobs but also for everyday life in our technology-full world.

However, there is more to technology in education. We need to look at the tremendous effect technology is having on our lives. Where do we study

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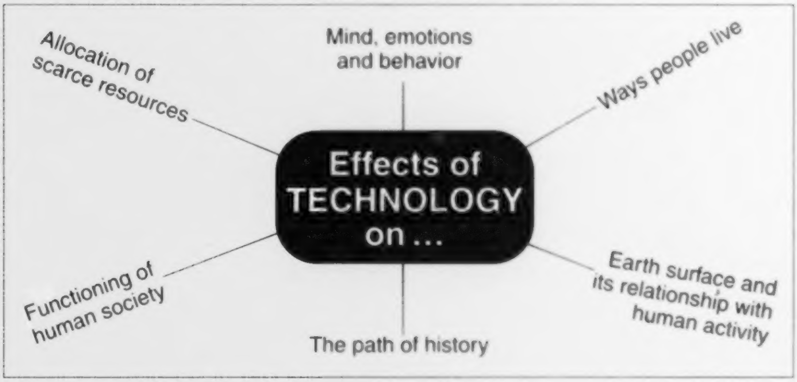
the social, economic, political, cultural, and psychological effects of technology on our lives, our future? In social studies!

In social studies, we encourage students to acquire knowledge of and develop a concern for the social issues facing our nation and world and to become informed and reflective thinkers, responsible citizens, productive members of society, and caring individuals.

Too often social studies is thought of as history, with perhaps a smattering of geography tossed in. However, it is much more. Social studies is defined by the National Council for the Social Studies as the "integration of history and the social sciences along with the humanities to promote civic education."[1] Each of the disciplines—anthropology, psychology, sociology, economics, geography, political science, and history—provides a different viewpoint of society.

In social studies, technology becomes more than just a teaching and learning tool. It becomes a topic of study in itself: How do the vast technological innovations affect different facets of society?


Effects of TECHNOLOGY on ...
Mind, emotions and behavior
Ways people live
Earth surface and its relationship with human activity
The path of history
Functioning of human society
Allocation of scarce resources

To give a flavor for the kind of discussions that need to happen, we first define the field and then include questions social scientists in those fields might be concerned with.

**Social (or Cultural) Anthropology** is the study of culture, the patterns of thinking, feeling, believing, and acting shared by the members of societal groups. The anthropologist may ask: How is technology influencing cultures throughout the world? Can cultures maintain themselves as distinct entities with all the outside influences? What will happen if they find they cannot? In adapting to new technological developments, what unintended changes will be brought about in other aspects of a culture, and how will culture members be able to deal with these changes?

**Geography** is the study of the earth and the way people live on it and use it. Technology has made a big impact on how data is gathered and created. Detailed maps help students get more and better information about far-off lands. Transportation and communication technology have changed the meaning of political boundaries. Building and industrial technology has made it possible to reclaim land and to build tremendous buildings, dams, and bridges. What impact is this engineering technology having on people's living conditions? How will nature react?

**Psychology** is the study of the mental processes, behaviors, and emotional adjustments of individuals. How is technology affecting individuals? How has technology changed the way people interact with each other? What effect has this had on our lives, our health? If we sit in front of computers day in and day out, working, playing computer games, watching videos or television, how does this affect our mental processes? And, what about the effects of radiation? How does all this engagement with technology affect emotional adjustment? Has it increased anxiety and stress? Does it create feelings of worthlessness and depersonalization in some of us? Do we feel like a number rather than a person?

**Sociology** is the study of human interaction within groups. How is technology affecting our social structures? Is it creating class struggles between those who have and those who do not have access to technology? If so, what can we, or should we, do about it? What about those who lose jobs as industry needs fewer skilled laborers? How will workers adjust to the ever shifting needs in the labor market? Has technology helped the physically challenged become part of mainstream society?

**Economics** is the study of how rational choices are made about limited resources and unlimited wants. The economist may investigate the costs and benefits of technology for the production of goods and services. To what extent has technology increased productivity? Does increased productivity translate into lower prices, and will lower prices ultimately result in a higher standard of living for all? Or will technology divide the world into the haves (those who use, understand, and can afford the technologies) and the have-nots?

**Political Science** is the study of the ways people organize and govern their political systems. Technology allows policy issues of the government to be communicated and shared with all citizens at a speed that is certainly different than even 25 years ago. How has this affected our democracy? Does increased knowledge and communication of our political organizations encourage citizens to take a more active role in society? How do new technologies challenge existing government regulation of patent and copyright laws?

**History** is not only the study of the past but also a search for the causes and effects of past events. It helps link the social sciences with a critical look at the past, present, and future. What is the history of technology? What types of technology were available during past eras and how did they affect the events of that time? For instance, the northern industries that produced cannon and firearms certainly had an effect on the outcome of the Civil War. What effect does our hi-tech, particularly our communication technology, have on history? Since information is now globally available, are we, in informing our people, also giving information to an enemy, and thereby altering history?

In thinking about the questions above, we, and our readers, will have trouble fitting them into a single discipline—many of the questions touch several of the social science disciplines. As an example, technology has made it possible to produce airplanes that travel more than twice the speed of sound. Blackouts in pilots of these crafts are making us question whether humans can take the stress of processing information at such high speeds (psychology). People can fly in supersonic jets from country to country, crossing geographic and political barriers almost like driving across town. Will this faster and faster travel contribute to the breakdown of the family and community or will it make it possible for farflung family and community members to remain a part of the family unit (anthropology)? What about the effects of supersonic booms on man and wildlife (geography, ecology, and psychology)? Who is able to take advantage of this rapidly shrinking world, who is included and who is excluded (sociology)? How has deregulation of air travel affected the profit margins of airlines and what are the results in cost, type, and number of flights available (economics)? How does international law interact with U. S. law over violations of air space (political science)?

These questions raised about the effects of technology are meaningful, but ones for which we have no ready answers. Our current students' lives are and will be affected by these issues, and they are the ones who will be dealing with them as they move from school into the world.

So, the study of technology and how it affects students, their families, their communities, and our society fits right into a natural place in school—the social studies. Social studies helps students reflect on, come to understand, and become active participants in our technology-rich world.

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**Footnotes**

[1] Definition of *social studies* was approved by delegates to the National Council for the Social Studies Conference held in Detroit in November 1992.

# Computers and Clarifying Mathematical Thinking

**Robin Durnin**

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***Robin Durnin**, a former elementary school teacher and mathematics computer specialist, is currently teaching eighth-grade mathematics at Kamehameha Secondary School. He received a grant from the National Science Foundation to enable him to do research on instructional uses of technology.*

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While working as a mathematics and computer resource teacher, I became fascinated with the idea that students could use computer and video technology for presenting proofs and visual models of complex math operations and for sharing their work with their classmates. The use of technology appeared to enhance students' understanding of mathematics. In my algebra and pre-algebra classes, therefore, I have my students *use technology to learn* about mathematics and also *learn to use technology* for sharing their understanding about mathematics.

Computer-based technology has become an integral part in my teaching of mathematical concepts. There are three types of activities for which students use the computer: LOGO programming, creating presentations to teach the solution of certain mathematical problems to other students in the class, and writing in order to explain their mathematical thinking. A brief example of each of these activities follows.

## LOGO and Signed Number Operations

The rules for doing mathematical operations with signed (positive and negative) numbers are easy to teach; students quickly learn to do the operations correctly by rote. But the concepts underlying these rules are very difficult to understand and prove. I use LOGO activities on positive and negative number operations to help students understand two aspects of the mathematical concept of opposites: *inverse operations* (forward and backward; left and right), and *inverse numbers* (positive and negative).

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The strategies and LOGO commands needed for developing the understanding of opposites in signed number operations are shown in the figure.

## INVERSE OPERATIONS

### in Creating LOGO Models of Signed Number Problems

**Retracing steps**

A simple example of retracing steps is drawing a line and returning to the original position; for instance, Forward (Fd) 50 spaces and Backward (Bk) 50 spaces brings the turtle back to the original position as does Left (Lt) 50 spaces and Right (Rt) 50 spaces.

A more complex example is from Papert et. al. (1979):[1]

| To Move Over | To Move Back |
|---|---|
| Pen Up | Pen Up |
| Rt 90 | Lt 90 |
| Fd 120 | Fd 120 |
| Lt 90 | Rt 90 |
| Pen Down | Pen Down |

In this example, the commands produce their effect. The inverse commands then bring the turtle back to the original position. In effect, the two sets of commands cancel each other.

**Cancelling a command**

An inverse command of the immediately prior command cancels the prior command so that it has no effect. For example, Rt 90 is cancelled by the inverse command Lt 90 so that it has no effect.

The difference between retracing steps and cancelling a command is twofold.

a) In the former, the commands produce their effect and in the latter they don't.

b) The order of commands relative to other commands differs.

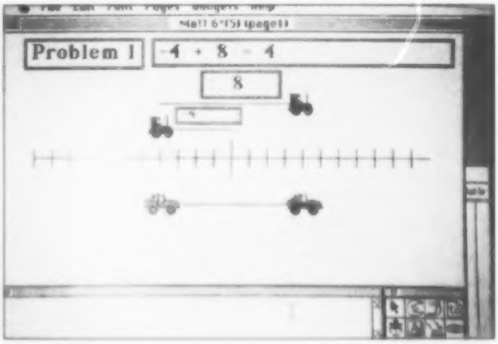
**Double inverse (or double negative)**

Two inverses within the same command are equivalent to no inverse. For example, Backward is the inverse of Forward; and a negative number is the inverse of a positive number. Therefore, Bk -90 produces the same effect as Fd 90.

I introduce the commands by showing on the projection screen what happens to the turtle—to what position the turtle moves—when I give a certain command. After this demonstration, I ask the students to predict where the turtle will go if I give a particular command. For instance, where will the turtle end up if I enter the command Fd 20?

Students then explore the effects of a series of commands in the computer lab. The computer provides the students with a responsive medium so they can immediately see the effect of a command. If a command does not do what they expect, students can try out another one.

After this kind of open-ended experimentation, I have students develop visual models and proofs for signed number operations. For example, a problem I might give them is (-4 + 8) = 4. One student developed the following visual model for this example.



Finally, the students learn to prove their answers by showing that the turtle ends up in the position predicted by their answer. In the above example, the turtle should be at +4 after making the movements that correspond to the operations on the signed numbers (-4 + 8). Through this immersion in developing LOGO graphics, students can see the usefulness of visual models for solving difficult problems.

## Instructional Presentations

The communication of their understanding of mathematical concepts forces students to clarify their thinking. I have my students, therefore, develop presentations to explain difficult chapter ideas. In their presentations, students are to include a clear statement of the problem, identify procedures for solving the problem, and use the mathematics vocabulary introduced in the textbook. Furthermore, the students are to include computer graphics in their explanations. The software used is the *Astound*[2] slide maker, which has the capability for making graphics and personalized soundtracks along with word processing.

When grading their presentations, I look at technological literacy as well as the quality of their instructional presentation. For technological literacy, I give them points for their preparation and the clarity and readability of their slides. For instructional presentation, I give points for problem identification and clear statement of purpose, clarity of solution steps or program building blocks, and quality of delivery, such as eye contact and pizzaz.

The creation of this multimedia presentation is, of course, quite motivating. Some students get so involved with the glitz of their presentation that they forget the primary focus of the activity—the presentation of difficult-to-learn math concepts. Throughout the construction phase of their presentations, I have to remind them about their focus and about making the information understandable to their audience.

I go through three rounds of such presentations, and each time the students' projects are more polished and have greater clarity.

## Writing

My third activity requires students to write a letter to an imaginary student who is absent. The letter is to describe important mathematical ideas and prepare the student for an examination upon his return to school. I thought up this activity because I was dissatisfied with how students reacted to problems they had missed on end-of-chapter tests. I used to give tests at the end of each chapter and then ask the students to redo the problems they had missed. We never reflected much on the reasons for their errors or on the concepts they had found difficult.

To help students in writing the letter, I give them the set of guidelines shown in the Letter Planner. This preparation allows each student to review problems missed and to try to understand the concepts underlying these problems. Set in this more authentic context, I have found students to be more interested in figuring out why they had missed problems on their test. As you can see in the student's letter on the next page, the students identify with the task.

### LETTER PLANNER

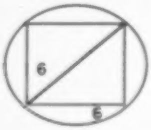
1. Develop a web for key concepts in the chapter
    a) First draft: in pencil
    b) Second draft: in *ClarisWorks* or *MindMap*
2. Outline the solutions to the problems you have chosen as the most important ones in the chapter. Explain the key ideas in phrases.
    a) Identify problems, outline related concepts, and show the solution
    b) Figure out how to put your ideas and examples into *ClarisDraw*
3. Write a letter explaining to a classmate the concepts she needs in order to comprehend the material on the Unit test. Remember, she has been absent for only this chapter so your letter should be designed to help her study for this test. You may refer to key concepts from other chapters and assume she understands them. Use the appropriate language in your explanations.

Dear Whoever You would like To be,

Since you have been sick, I thought that you would like some help with the three hardest parts in Chapter 9. If you do not know what they are already, I will tell you. They are 9.4: Pi and the circle; 9.5: Properties of real numbers; and 9.7: Graphs of equations. I will give you hints and clues, and examples on how to do them.

9.4 : Pi and the circle is mostly about the Right Angle Property which says that if one line is the diameter of a circle and another point on the circle completes the circle, other than the other line, then triangle ABC is a right triangle. The diameter of a circle if you did not know it already, is used in finding the circumference of a circle with pi. A chord is a line other than the radius and diameter on the circle. I know that these concepts are hard to grasp so I will help you by giving you a problems and drawing a solution model.

Find the area of the circle with sides of the square equaling 6



Given the diagonal is equal to the diameter and this is twice the radius we can figure out the length of the radius by using the Pythagorean theorem

Did you do it right? Good! That means we can go on. You probably thought that you would never have to work with the Properties of Real Numbers...wrong. You should apply properties realizing that division and subtraction are not associative or commutative by nature. For example,

1. Associative Property of Multiplication: $a(bc) = (ab)c$
2. Associative Property of Addition: $a + (b + c) = (a + b) + c$
3. Commutative Property of Multiplication: $ab = ba$
4. Commutative Property of Addition: $a + b + c = c + a + b$

Also, you should know the Zero Product Property: If $ab = 0$, then either a or b is equal to 0. A sample problem that you should be aware of is $2(x-3) = 0$. In this problem $a = 2$ and $b = (x-3)$. For the algebra expression to be equal to zero, bu must equal zero so x must be 3 (i.e., $3 + (-3) = 0$). This type of problem takes some getting used to but I think that you will get it.

Sample of student letter

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This activity could be done without a computer. So, what is the advantage of using a computer? Again, as with the presentation task, I find that the students can communicate their understanding better with the graphics made possible by the computer software. Also, the motivation is much higher because revisions and editing are so much easier with the word processor and the product looks much more professional.

## Conclusion

These activities admittedly take time. However, I have found that the computer with its visual possibilities provides immediate feedback and deepens understanding. It allows students to visualize mathematical concepts and to obtain immediate feedback about their choices in solving problems. Furthermore, the multimedia technology makes it easier, and therefore more motivating, for students to share their understanding of concepts. And, I firmly believe that one learns a subject best by teaching it to others. As Glasser reminds us, we remember only 5 percent of what we read and 80 percent of what we experience, but a whopping 95 percent of what we teach to someone else. With the technology, students are willing to take the time needed to create excellent products to communicate their ideas. And, if they can communicate them, they understand them.

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**Footnotes**

[1] Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas.* New York, NY: Basic Books.

[2] Astound [Computer software]. (1993). Mississauga, Ontario: Gold Disk.

# Charting the Future*

## Lance Tachino

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**Lance Tachino,** *before becoming a Systems Analyst with the Information Systems Division of Kamehameha Schools Bishop Estate, was the Educational Technology Coordinator for KSBE. With degrees in secondary education and computer science, he combined his experiences in education and the computer-science industry to develop Kamehameha Schools' technology plan.*

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Like other schools in this state, Kamehameha Schools Bishop Estate finds itself at a technological threshold. Computers, laserdiscs, CD-ROM, television networks, cable and satellite technology provide vast quantities of data and experiences at the touch of a button; the integration of computers with a multitude of video images, telecommunications, desktop graphics, and video publishing has opened an expressway into the twenty-first century with unlimited possibilities for teaching and learning.

Planning for these possibilities is challenging: "If all we do is bring technology into the classroom, there is no reason to think that anything positive will happen as a result. On the other hand, if we think carefully about the goals of education, and how technology can be used in support of these goals, then computers can be very useful."[1] "Technology is, by itself, neutral. The hammer with which Michelangelo created the Pieta can be used to destroy it."[2]

The development of a technology plan for the educational needs of Kamehameha Schools Bishop Estate (KSBE) has fallen to the Information Systems Division. But how to go about developing a plan for such an enterprise? I decided to set up a committee, and in the summer of 1992, I recruited teachers, administrators, support staff, and outside consultants to help in formulating the plan.

Guided by Thornburg's contention that current technology can create as vast a change in education as the Gutenberg printing press did in the

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*This article grew out of *Charting the Future, The Educational Technology Plan,* (September 1994), Education Group, Kamehameha Schools Bishop Estate, Honolulu, Hawaii.

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expansion of literacy, the committee saw multimedia technology as an instrument for another such revolution and a tool with which KSBE could chart its future. To develop a strategy for improving education through the integration and use of technology in all instructional programs and at all levels of learning became the goal. Technology, integrated with instruction, was to be used to support the education of Hawaiian students and to motivate them to become eager and life-long learners, proud of their accomplishments and culture.

To be relevant, a plan must build upon the current situation. The committee sent out surveys to find out the attitudes and habits of students, teachers, and parents with regard to the computer and other multimedia technology. We obtained the following information to guide our work:

- At all grade levels, Kamehameha Schools students were using computers at home and at school; use at school was limited by availability and level of computer and software training.
- Teachers and staff were using or willing to use technology. Only about 10-15 percent were reluctant technology users.
- Teachers were using computers with their students mainly for practice and drill, and for word processing. Few were using it for grading, class scheduling, lesson-plan development, and e-mail.
- Students and teachers overwhelmingly indicated they preferred to have the technology in the classroom than in labs.
- All expressed the desire for hands-on and collegial training opportunities.

This information was encouraging. Teachers and students were willing to learn to use new technology; we would not have to spend much time convincing them. But the survey also showed that we needed to give students and teachers broader access to computers, particularly in the classroom, and that we needed to help them use the newest technology and familiarize them with ways this technology could enhance their work.

To round out the information, the committee interviewed a number of staff, students, parents, and teachers to get their thoughts about what the ideal teaching and working environment might be like in the year 2000. Five visions emerged for how technology might help us in educating our young people.

### *Bringing the World into the Classroom*

The world can be brought into the classroom by using distance learning to create classrooms without walls, by using multimedia resources to provide students with lifelike exposure to different cultures and environments, and by having students and teachers do collaborative projects with other students, educators, and business people around the world.

*Enhancing Communications*

The technology to communicate with others is increasing dramatically in its scope while becoming easier and easier to use. Using video technology, we can conference face to face with people who are miles across the Pacific. We can write notes on e-mail and get answers back in minutes, whether we are writing to someone down the hall or on the East Coast; no longer will teachers have to carry pen-pal letters to the post office and wait weeks for a reply.

*Expanding Instruction*

The multimedia technology has infinite instructional possibilities. For instance, technology such as CD-ROM offers many benefits over textbooks. CD-ROMs can hold all kinds of information in addition to regular text—sound files, film clips, animations; the information is retrievable in seconds; and learners can construct their own pathways to knowledge. Teachers will be able to supplement their lectures with multimedia technology to make them more engaging and clearer for students. Students with differing learning styles will have another avenue for learning and for expressing their knowledge. Students' reports will change. Once they have access to multimedia workstations, they can create electronic and video reports and portfolios. The new technologies will even change the face of student assessment.

*Automating Administration of the Classroom*

Technology can be used to automate administrative tasks such as computerizing scheduling, updating and maintaining student grades, and providing easy access—from the classroom or from the school office—to previous student records.

*Increasing Family Involvement*

Electronic bulletin boards can be used to inform parents about activities and assignments; e-mail can also make communication between parents and teachers easier. Training adult family members in the technology that their children are using at school will not only familiarize the family with technology, but will also create situations in which parents and children can learn together.

## Research on Technology in the Classroom

Transforming the learning environment means transforming teachers and students. This transformation cannot occur overnight; rather, it will evolve as teachers and students grow and develop with the technology.

Teachers will need to learn how they can use this technology to enrich their teaching and to ease some of the managerial burdens of daily teaching. An Apple Classrooms of Tomorrow (ACOT) study looked at how teachers and students adapted to computers in the classroom and how teaching and learning changed.[3] The study found that, when adjustment was successful, teachers and students went through stages.

During the *Entry Stage*, teachers started to learn what could be done with the equipment and software. Expecting that computers would make their job easier, they tended to become frustrated with setting up and debugging the computers and wondered whether the time put in would pay off for themselves and for students.

In the *Adoption Stage*, teachers became more confident with the technology and began to use it to support traditional teaching practices such as drill and practice instruction. Student achievement tended not to increase in this stage, but self-esteem and motivation appeared strong, and attendance and discipline improved.

In the next stage, the *Adaptation Stage*, teachers learned to integrate technology into their teaching. Students became more productive, moving through the curriculum more quickly. They wanted to work on the computer during recess, lunch time, and after school. Technology was starting to help teachers and students do traditional tasks in more efficient and effective ways.

As teachers mastered the technology, they reflected on its uses and began to question their old ways of teaching. In this stage, the *Appropriation Stage*, teachers began to shift to team-teaching and interdisciplinary, project-based instruction. Some altered their instruction schedule to allow more time for longer projects. Students became skilled with the technology. They got better at learning on their own and teaching each other; their motivation continued to improve; and they began to discover ways that technology could help them do new things.

In the *Invention Stage*, teachers came to see learning as an active, creative, socially interactive process and to realize that knowledge cannot be transmitted intact from teacher to students, but is something students must construct. They created environments to provide students with experiences needed to acquire high levels of knowledge and skills and constructive interpersonal behaviors; some teachers began to work with administrators to modify their curriculum so that it provided students with more usable, applicable knowledge and skills. Students learned to conceptualize, plan, and conduct long-term projects, and to assess and monitor their progress toward goals. Technology was helping students and teachers do new and different things beyond accomplishing traditional tasks better and more efficiently.

Among the benefits of technology reported for students were the expansion of classroom boundaries; improvement in learning, retention, and transfer of information; greater self-direction; more problem solving and higher levels of thinking; and fewer behavior problems. The reported benefits to teachers included the opportunity to design more personalized and motivating instruction and the use of more efficient and creative methods for curriculum development; facilitation of doing routine tasks, such as grading, and doing portfolios and other modes of student assessment; and facilitation of communication with other teachers, students, parents, and administrators.

## Charting the Future

The information from our survey, the research on teacher and student learning with computer technology, and our knowledge of what technology is out there for us to use helped us develop the educational technology plan, "Charting the Future." The plan defines for KSBE a strategy to fulfill the five-part vision and improve education through the integration and use of technology in all instruction. A schema of the original plan is shown in figure 1. The plan includes the network and the hardware for

- all classrooms from kindergarten through grades 12
- all administrative departments
- library management
- student information (record) systems
- access to public information and telecommunication networks
- remote user access so teachers and students can access the system after hours

The plan also details networked video services for video conferencing, distance learning, and for production of custom image capture and custom animation. Fundamental to the plan is that all parts of the campus will be connected through a fiber-optic "backbone," allowing everyone to communicate with each other and to access the campus-wide software programs and state and national information sources. We are now in the middle of putting in this backbone.

Since the plan includes many details, I would bore most readers if I were to go into all the bits and pieces. So I will talk only about what is to happen at the classroom level. Actually many pieces are already in place.

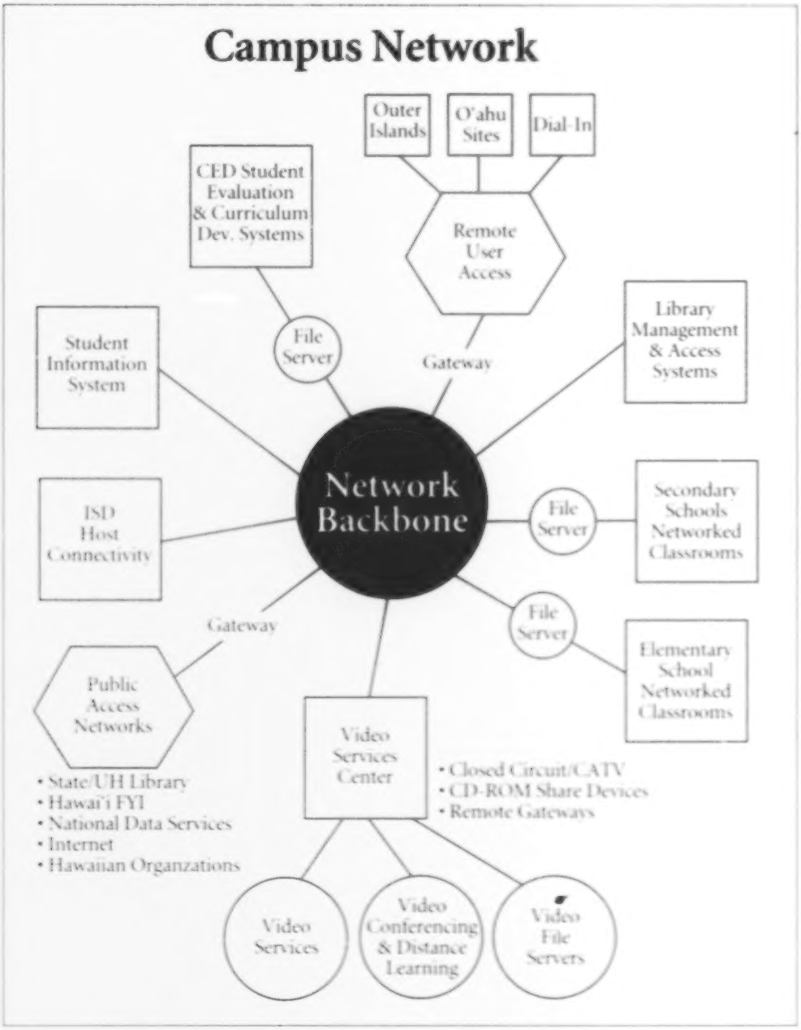
Campus Network
Outer Islands
O'ahu Sites
Dial-In
CED Student Evaluation & Curriculum Dev. Systems
Remote User Access
Library Management & Access Systems
Student Information System
File Server
Gateway
Network Backbone
ISD Host Connectivity
File Server
Secondary Schools Networked Classrooms
File Server
Elementary School Networked Classrooms
Gateway
Public Access Networks
• State/UH Library
• Hawai'i FYI
• National Data Services
• Internet
• Hawaiian Organzations
Video Services Center
• Closed Circuit/CATV
• CD-ROM Share Devices
• Remote Gateways
Video Services
Video Conferencing & Distance Learning
Video File Servers

Figure 1. Campus network.

Each classroom, from kindergarten through grade 12, is to have a teacher workstation and a student workstation connected to the fiber-optic backbone. The *teacher workstation* includes a computer, a large screen, a printer, a storage device, a CD-ROM drive, and possibly a scanner, a video recorder, and fax machine.

This workstation allows teachers to present information on the large screen to the whole class and to accompany their instruction with graphics, sound, and video they have developed in class (often together with their students) or taken from books or other sources. Cathy Weaver's article in this issue is an example of how the teacher can use this workstation for these purposes.

To supplement the teaching of difficult concepts, a teacher can make use of distance learning or teleconferencing with specialists. The article by Meyer provides us with examples of these uses.

The teacher workstation also gives easy access to information about the student and can make record keeping, grading, and creating tests easier. It allows the teacher to communicate easily with colleagues, administrators, and parents.

The *student workstation* consists of four to six computers connected to each other and to the teacher's workstation. This setup lets students work in small groups, using the computer as a research and problem-solving tool; it allows them to practice and learn on their own without teacher supervision; it gives them access to databases in libraries and to other online information systems; it provides them with opportunities to learn important computer applications such as word processing, graphing, or spreadsheets.

Shared *mobile multimedia stations* provide teachers with the equipment to create multimedia presentations. These stations consist of audiovisual equipment, such as a video monitor, videotape recorder, laserdisc player, bar code reader, and video camera.

In addition to these stations, which are available for classroom use, are three other centers. In the *teacher resource centers,* teachers can use the most advanced technology to prepare curriculum materials. A technology specialist is available to help teachers in using the complex technology. These resource centers are also places for teachers to find out about new hardware and software and to try it out.

The *student multimedia room* is for student use. Here students, under the guidance of a technology specialist, learn to make multimedia reports for their classroom projects. Again, advanced digital technology will be at their disposal. An example of this use is described in the paper by Fasick and McLaren, this issue, on student electronic portfolios.

*Instructional labs* are for large-group instruction on computers, such as keyboarding, software, or computer-science classes. These labs can be used for students or for teacher and staff workshops.

If everything were to be put in place at once, there would be chaos, and the expensive equipment would gather dust. Thus, a major part of the plan describes how the technology and the training would be phased in over four years. The teacher and student resource centers are starting on a small scale and will be expanded only with increasing demand. After the four years, we will shift our attention to systematic upgrading and replacement of equipment.

The key to successful use of this complex and diverse technology is staff development. Teachers need to learn about the capabilities, limitations, benefits, and appropriate uses of various technologies; they need ideas on how to integrate technology into their curriculum and on how to incorporate these new tools into their teaching. As their role changes from giving information to promoting student exploration and critical thinking, they need to become comfortable in structuring technological learning environments for all learning styles and abilities. To accomplish all this, release time, accessible help, and a progressive and ongoing learning program are necessary.

In developing our technology training and support program, we have taken these needs to heart. Our staff development program is ongoing. It has two strands. One strand focuses on how to incorporate technology into teaching and into the curriculum. Discussion topics will include such themes as presentation and teaching techniques, critical thinking, cooperative learning and the computer, computers and the writing process. The other strand focuses on helping teachers use specific hardware and software. We have basic computer training for using Macintosh and IBM or IBM-compatible computers, and for *Hypercard* (MAC)

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and *Linkway* (IBM); we will have courses and other inservice training on specific applications—using a certain software, doing multimedia productions, using the scanner, and so on; and we'll have inservice sessions that focus on particular teacher interests.

Since teachers vary in their needs and learning styles, training is offered in many different ways: inservice workshops and classes in the computer labs, direct training in the classroom, and videotaped tutorials. Perhaps the most effective learning situation will be the teacher resource center where teachers have a purpose for using the technology and have a technology consultant at hand.

Release time and administrative support are essential to exploring and becoming familiar with complicated new technology. Summer projects, release time during the school year to do projects that explore a technological need for the school, sabbaticals, and summer study grants are just a few possibilities we are considering.

Originally, to make sure that the curriculum would drive the technology and that technology would be integrated well into the curriculum, I had the vision of a curriculum committee for grades K through 12 that would decide on the important concepts students need to learn in different subject areas. Then I would be able to help teachers find or develop software and other technology to support learning these concepts. This somehow never worked out; the teachers were very reluctant to do that.

But our present approach, where teachers select from our training offerings and we respond to their requests, may be better. From articles in this journal, it seems that teachers are using technology to support their own curriculum and their teaching as they see fit and feel comfortable. Since teachers do have different teaching styles, just as our children have different learning styles, they will come to use the technology so that it enhances their personal style. The integration and use of technology will, therefore, look very different from one classroom to the next—and our fears that technology will make us all the same will be unfounded.

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**Footnotes**

[1] Thornburg, D. D. (1991). *Edutrends 2010: Restructuring, technology, and the future of education* (p. 124). Thornburg & Starsong Publications.

[2] Thornburg, *op cit.*, p. 49, see footnote 1.

[3] Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1991). Changes in teachers' beliefs and practices in technology-rich classrooms. *Educational Leadership, 48*(8), 45-52.

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